The First Hundred Years of the

SMITHSONIAN INSTITUTION

1846-1946

WASHINGTON, D.C.

The Smithsonian Institution
1946

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By
WEBSTER P. TRUE
Chief of the Editorial Division of the Institution

Washington, D. C.
August 10, 1946

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Smithsonian Institution

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1946

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* Owing to the deeply regretted death on April 22, 1946, of Chancellor Harlan F. Stone, the office of Chancellor will be vacant until election of a new incumbent by the Board of Regents. Chancellor Stone was actively interested in the Smithsonian Centennial and had expected to participate personally in the various phases of the event.

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THE Smithsonian Institution is an American tradition. Five generations of Americans have been familiar with the name "Smithsonian" and have associated it—perhaps more or less vaguely—with some sort of a cultural organization and museum in Washington where information on anything under the sun may be obtained. Relatively few people, however, have known of its origin, its gradual but steady expansion as a national scientific institution, and the amazing volume of basic research by which it has aided in building up American science from a very small nucleus to the commanding position it occupies in the world today.

As the Smithsonian Institution crosses the hundred-year mark, it is well for it to pause and look back over a century of activity to see how it has succeeded in carrying out the behest of its founder and to try to discern how best it may serve mankind in the centuries to come. A hundred years is a long time measured on the scale of a man's lifetime, but looking back down the long vistas to the period of man's emergence into the light of civilization, it is but a minute space on the historical time scale. For the Smithsonian it is merely a conventional interval. The Smithsonian had a definite beginning but has no foreseeable end. Its stated purpose knows no time or space limits, and it will go on through the centuries, changing with a changing world and so adjusting itself that it may fill a useful role in the upward struggle of mankind.

Although the last hundred years form but a very small fraction of man's recorded history, yet that brief period has seen greater changes in his way of life than all the time that preceded it. New means of transportation and communication have suddenly shrunk his physical world until the peoples of all lands are literally neighbors. Mechanical labor-saving devices have given to each common man in advanced nations the equivalent of 30 slaves, and the making of goods by machinery has yielded him far more leisure than his ancestors enjoyed. These and many other drastic changes have come through one basic source—the rapid and ever-accelerating growth of science. The Smithsonian in all modesty may rightfully claim a part of the credit for this growth, for the Institution happened to come into being at the time

when science in America was in its infancy and urgently needed support, encouragement, and coordination.

Until the middle of the last century, the United States—itself then less than a century old—offered to science little of the popular appreciation and support so essential to healthy growth. Scientific institutions as they are known today were almost nonexistent, and the available media for publication and dissemination of new discoveries were meager. Into this scene stepped the new Smithsonian Institution with the avowed purpose of increasing and diffusing knowledge on a national and international scale. The very founding of the Institution aroused nation-wide interest in matters of science, and the provision of grants for research, the widespread encouragement of scientists, and the creation of a series of publications for the dissemination of knowledge all went far to promote scientific progress. It is difficult to evaluate in retrospect the precise effect of such events, but it is safe to say that science in America received a powerful stimulus at a critical time through the establishment of the Smithsonian Institution.

Since those early days the Smithsonian has expanded its field of activities in the promotion of science in ever-widening circles. In these pages are reviewed briefly the unusual story of its origin, the rise of the bureaus through which it operates, and some of the interesting aspects of its work in research and exploration.

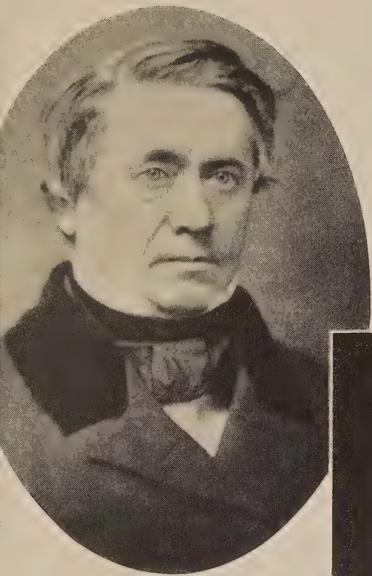
Alexander Wetmore

Secretary, Smithsonian Institution.

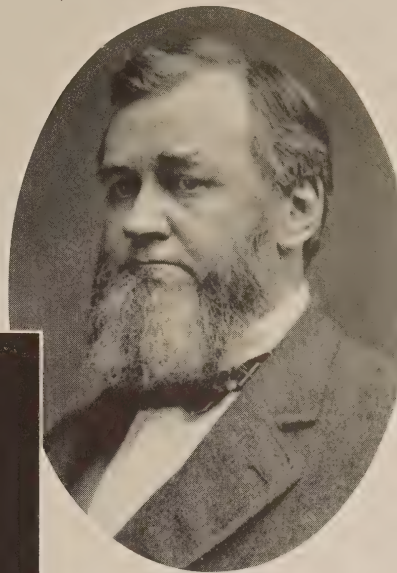
THE SMITHSONIAN INSTITUTION

SECRETARIES

1846-1946



JOSEPH HENRY
1846-1878



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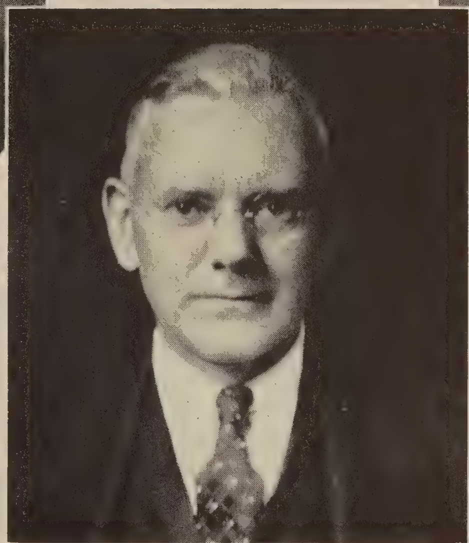
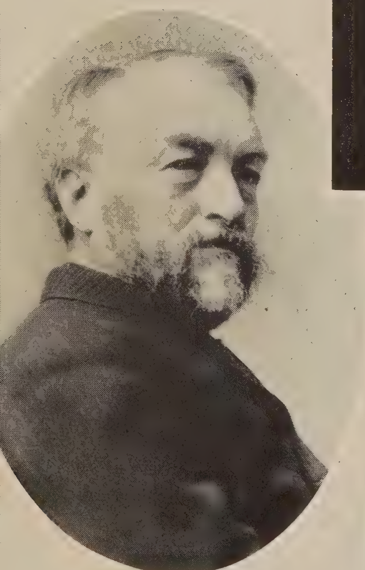


ALEXANDER WETMORE
PRESENT SECRETARY



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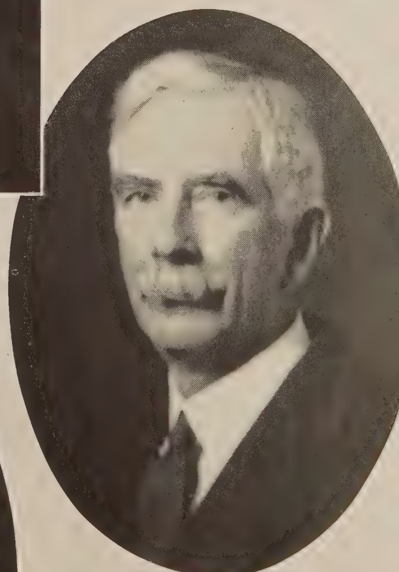

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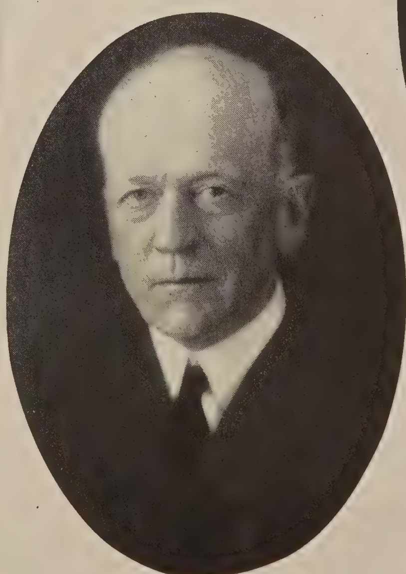


CHARLES DOOLITTLE WALCOTT
1907-1927

Upper, James Smithson, founder of the Smithsonian Institution. *Lower,* tomb of James Smithson. His remains were brought from Italy in 1904 and given a place of honor in the institution he founded.

I

ORIGIN OF THE SMITHSONIAN INSTITUTION

JAMES SMITHSON, the founder of the Smithsonian, was not an American, but an Englishman. He was born in 1765, the natural son of the Duke of Northumberland and Elizabeth Keate Macie, a lineal descendant of King Henry VII. Because of the circumstances of his birth he was not permitted to assume any titles, and in seeking for the reasons—which are nowhere recorded—why he left his fortune to the United States to found the Smithsonian Institution, this fact should be borne in mind. Smithson never visited America, and he had no friends there, so that we are forced to look beneath the surface for an explanation.

Smithson was graduated from Pembroke College, Oxford, in 1786, and the following year was admitted as a Fellow of the Royal Society because of his proficiency in chemistry and mineralogy. He immediately set about the scientific investigations that attracted him so strongly, working both in England and in France. Chemistry at that time was so new a science that, as Smithson himself wrote in 1802, "what we know of it bears so small a proportion of what we are ignorant of; our knowledge in every department of it is so incomplete, consisting entirely of isolated points, thinly scattered, like lurid specks on a vast field of darkness, that no researches can be undertaken with-

out producing some facts leading to consequences which extend beyond the boundaries of their immediate object."

Manipulation in chemical analysis of small quantities of substances was Smithson's particular forte. At the time he worked, chemical apparatus as we know it did not exist, and in making his delicate analyses Smithson had to improvise his appliances from whatever materials were available. In spite of the difficulties arising through the use of primitive apparatus and crude reagents, some of his experiments achieved results that would be considered creditable today. Some 27 published papers record his investigations in chemistry and mineralogy, and nearly 200 manuscripts written by Smithson were found after his death, in addition to thousands of notes. He was an intimate friend of some of the renowned scientists of that day, notably Cavendish and Arago, and corresponded regularly with many more. In mineralogical nomenclature he is commemorated by the name "smithsonite," an important ore of zinc.

Although perhaps not to be classed as a great scientist, nevertheless James Smithson was one of the leading investigators of his time, and he contributed no little to progress in those early days of science. What is even more important, however, in the light of his final act that brought him fame, is his almost modern attitude toward the importance of exact knowledge and his eagerness to aid in expanding mankind's mental horizons.

Little is on record of Smithson's later life except that he was in very poor health and that he spent most of his time in Paris, where he continued his scientific work. At the age of 61, a broken and lonely man, he wrote his will, an act that accomplished what a lifetime of painstaking research failed to do, the perpetuation of his name. He provided first for an old servant and then left the remainder of the income from his estate to a nephew, Henry James Hungerford. Upon the nephew's death, the entire property was to go to his heirs, if he left any—if not, Smithson wrote, "I then bequeath the whole of my property . . . to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

In speculating on the reasons for James Smithson's unusual bequest, we see first the obvious fact that the circumstances of his birth rankled

within him. That some such attempt to counteract this had long been in his mind is apparent from a sentence that he once wrote: "The best blood of England flows in my veins; on my father's side I am a Northumberland, on my mother's I am related to Kings, but this avails me not. My name shall live in the memory of man when the titles of the Northumberlands and the Percys are extinct and forgotten."

But why should an Englishman who had lived most of his life in France leave his fortune to the United States of America, a very young nation and one in which he had never set foot? Here we are reduced to pure speculation, but it may be significant to note that Europe for years had been ravaged by wars, whereas for America James Smithson doubtless visioned promise of lasting peace and freedom of thought and action. It is also interesting that the wording of Smithson's bequest bears a striking similarity to a phrase in George Washington's Farewell Address: "Promote, then, as an object of primary importance, institutions for the general diffusion of knowledge."

But what stands out without question in Smithson's will is the clear statement of his own ideal, "the increase and diffusion of knowledge among men." Far in advance of his time, he saw that man could hope to better himself and his living conditions only by taking knowledge out of the hands of a chosen few and making it available to all. Smithson himself devoted his entire life to a conscientious and capable attempt to expand the existing knowledge of the world about him, but the very work he did led him to realize how few men had opportunity to acquire the requisite education and point of view to cause them to appreciate and encourage cultural pursuits. Therefore, in writing his will, he hoped that in addition to perpetuating his name he might project into the future his own ideal of causing the value of greater knowledge to be more widely appreciated.

James Smithson died in Genoa, Italy, in 1829, and the nephew named in his will survived him by only 6 years, dying without heirs in 1835. In September of that year, the American chargé d'affaires in London notified the Department of State of the Smithson bequest, and President Jackson in turn notified Congress in December of the same year. The unusual nature of the bequest touched off a flood of debate in Congress, some Senators arguing strongly against its acceptance on the ground that it would be beneath the dignity of the Nation to receive

a gift from a foreigner. Most members of Congress, however, were in favor of accepting the bequest, and some—in particular John Quincy Adams—were loud in their praises of Smithson for his far-seeing benefaction. After the oratory had died down, Congress passed a bill accepting the bequest and authorizing the President to prosecute the claim.

He at once selected for the job Richard Rush, a prominent lawyer who had held several Federal posts including those of Secretary of the Treasury and Minister to England. Rush went to London and entered friendly suit on behalf of the United States in the Court of Chancery. Although some 800 cases were ahead of this one, and even English lawyers told him that chancery suits often lasted a lifetime, nevertheless he successfully prosecuted the claim in the unprecedentedly short time of 2 years. Changing the entire assets into gold sovereigns, Rush sailed for America on the packet *Mediator* and arrived in New York August 29, 1838. He then proceeded directly to the mint in Philadelphia where he turned over the gold and received a receipt for $508,318.46. Various sums subsequently received from the estate brought the total bequest to $550,000.

In these days of multibillion dollar budgets, Smithson's bequest seems a comparatively small sum, but a century ago it was a great fortune. Furthermore, the potential benefits from such a gift cannot be measured in terms of size alone; the conditions and restrictions must be considered. Smithson's one condition, that the institution he visualized should be for the increase and diffusion of knowledge among men, is perfectly clear and unambiguous. Of restrictions, there are none. Any field of knowledge, any method of procedure, any locale on earth is acceptable under the terms of the will, as long as the proposed activity has the potentiality of accomplishing the general purpose. And therein lies the amazing far-sightedness of James Smithson's bequest, for the very broadness of the wording permits the Institution to take up any desired line of investigation, unhampered by delimiting restrictions.

II

THE SMITHSONIAN IS LAUNCHED ON ITS CAREER

IN retrospect it is difficult on first thought to see why it took Congress 8 years to set up an institution for the increase and diffusion of knowledge among men. The answer is that although James Smithson, whose whole life was lived in scientific circles and in the absorbing atmosphere of scientific investigation, knew exactly what he meant by the wording of his will, for American legislators the wording had no such specific meaning. Therefore, when President Van Buren informed Congress that the bequest had been received, a flood of schemes was loosed that were as diversified as the interests of the individuals who proposed them.

The favorite proposal was for a university, usually a sort of post-graduate school of higher learning. This might seem at first glance to be a logical solution, but on closer examination it becomes clear that if this had been wanted by Smithson he would have said so in so many words. Many other kinds of educational institutions were also proposed, including agricultural and normal schools. Ex-President John Quincy Adams wanted a great astronomical observatory; others preferred a library, a physical research laboratory, a meteorological bureau, or a school of astronomy. Fortunately, however, none of the

specialized schemes prevailed, and debate in both houses of Congress went on and on.

For a time it appeared likely that the National Institute, an organization created in 1840 to promote science, would receive the Smithson bequest, but after years of effort toward this end by its officials, the plan failed to receive the approval of Congress and the Institute disbanded. This seeming failure was, however, in one sense a great success—it brought forcibly to public attention the value of science and its need for support. The National Institute's efforts without doubt saved the Smithsonian from becoming a school, or at least something far less broad than its founder intended.

Finally, Robert Dale Owen, of Indiana, introduced a bill that seemed to meet with wide approval, and a substitute bill with some modifications, offered by William J. Hough, was passed by Congress and approved by the President on August 10, 1846. Thus was the Smithsonian established after 8 years of debate. The Act of Incorporation provided for an Establishment, a governing body—the Board of Regents—a Secretary who should direct the affairs of the Institution, a suitable building, a museum, an art gallery, a chemical laboratory, and a library. It further provided that all objects of art and of natural history then belonging to the Government in Washington should be turned over to the Institution. These constituted all the major stipulations contained in the act, Smithson's intent remaining unhampered by detailed instructions. The new Institution therefore was left free to carry out in whatever manner it deemed best the donor's proviso for the increase and diffusion of knowledge among men.

The Board of Regents is composed of the Vice President of the United States and the Chief Justice of the United States, one of whom, usually the Chief Justice, has always served as the Chancellor; three United States Senators and three members of the House of Representatives; and six eminent private citizens. As examples of the outstanding Americans who have served on the Board may be mentioned Presidents Fillmore, Johnson, Garfield, Arthur, Theodore Roosevelt, Coolidge, and Taft; Asa Gray, James Dwight Dana, Louis Agassiz, Stephen A. Douglas, Rufus Choate, and Alexander Graham Bell.

It was very apparent to the first Board of Regents that the selection of a Secretary would largely determine the effectiveness of the new

Institution, and they made this selection with the greatest care. The man finally chosen was Joseph Henry, an outstanding scientist, and Henry's plan of organization was so sound and far-seeing that it has never been found necessary to make any material change in its basic principles during a century of operation.

In interpreting the meaning of the bequest, Henry bore in mind the fact that Smithson's sole interest in life was scientific investigation, and it therefore seemed certain that in his will he intended to provide for the continuation of such work. For the increase of knowledge Henry's plan contemplated the support of scientific research, both through major projects at the Institution itself and through grants to outside workers in promising fields of investigation. The diffusion of knowledge he proposed to accomplish by publishing the results of original research in a series of memoirs and distributing them throughout the world. He also proposed to include in the Annual Report of the Board of Regents a series of papers showing current progress in the various branches of science. Along these two major lines Henry planned to develop the work of the Smithsonian Institution, and within this framework he established several principles of action intended to make the Institution's funds as effective as possible.

His first principle was to avoid the permanent obligation of funds for the maintenance of a large physical plant and equipment and a complex organization. He believed that Smithsonian funds should be kept free as far as possible in order that support might be transferred from one project to another as circumstances dictated.

He decreed that no branch of knowledge should be excluded from attention by the Institution. No limitation had been placed by Smithson, and Henry could see no reason for visualizing the Smithsonian as anything less broad than Smithson's own conception. This principle was modified, however, by the dictum that the Institution should not plan to engage in any activity that was adequately provided for by other agencies.

Last, and perhaps most important of all, he established the principle of universal cooperation. The Institution was to work with all other agencies interested in the promotion of knowledge and to aid in any way it could any serious applicant for assistance in advancing learning. This principle was at once effective, for sources of aid in scientific work

were almost nonexistent in America at the middle of the last century. Henry looked on the new Institution as a catalyst, initiating reactions that would increase knowledge but using up no more of its own substance than was necessary to insure success of the projects aided.

It was indeed fortunate for the Smithsonian that a man of Joseph Henry's caliber was chosen to shape its destiny. He was a man of high ideals and strong character, and, having accepted the post, he gave the rest of his life without stint to making the Smithsonian what he felt the founder wanted it to be. Prior to his appointment, he had been professor of mathematics at the Albany Academy for 6 years and professor of natural philosophy at the College of New Jersey (now Princeton University) for 14 years. During this 20 years as a professor and research worker, he had established a wide reputation as a brilliant investigator, and many of his discoveries were epoch-making. He improved the electromagnet from a useless toy to a powerful instrument capable of lifting 3,500 pounds. Through discovery of the intensity magnet, Henry in 1829 or 1830 succeeded in ringing bell signals at a distance of 8,000 feet; later this discovery facilitated the development of the telegraph. He also discovered the principles of self-induction, the unit of which is named the henry in his honor, and magneto-electricity, the principle on which are based all modern electric motors. In addition to his pioneering work in the field of electricity, Henry made notable studies in molecular physics, light and heat, as well as in meteorology.

When he came to the Smithsonian, Henry realized that he would of necessity have to give up his own researches, but this sacrifice he made willingly because he felt that he could make a greater contribution to the advancement of learning by providing encouragement to others through the agency of the Smithsonian Institution. His judgment was correct, for the starting of the new Institution opened a new era of American science, giving to it a vigorous impulse that has carried it in ever-increasing tempo down to the present day of great achievements in every branch of endeavor.

The Smithsonian's first project was a series of publications known as Smithsonian Contributions to Knowledge, of which the first number was "Ancient Monuments of the Mississippi Valley," by Squier and Davis. This famous monograph, the result of extensive explorations

Part of the Herbert Ward African Collection in the U. S. National Museum. The weapons and other specimens were collected by Mr. Ward,

Racial types as displayed by models in the U. S. National Museum *Left to right.* Mohave Indian chief, Papuan man of the Fiji Islands, Australian aborigine with boomerang, Jivaro Indian chief of Ecuador.

and surveys, is still a standard reference work for archeologists. Thus began a long series of publications in all branches of science, each the result of original investigations, that have continued to the present day in increasing number and scope. The Contributions made it possible for the scientists of the middle of the last century to publish elaborate accounts of their discoveries, and the wide free distribution of the series accelerated the progress of science throughout the world, but particularly in this country at a time when publication media were very few in number.

The first scientific project started by Secretary Henry was in the field of meteorology. It is hard for us to realize that a century ago, although some attempt was made to observe and record weather conditions, few meteorological principles had been formulated, and forecasting was an unknown art. We have come to take the daily weather forecasts so much for granted that the stopping of these during the first years of World War II came as a real hardship. Henry felt that the time was ripe to extend weather observations and to apply the data to the problems of the movement of storms in America. He therefore organized weather observers in many parts of the country, including those connected with the Army, into a unified system and interested many persons in becoming volunteer observers, so that by the end of 1849 he had 150 stations recording local weather conditions. Methods and instruments were standardized, and directions and meteorological tables were printed and furnished to the observers.

The telegraph at that time was expanding rapidly, and Henry succeeded in having operators in all parts of the country report weather conditions every day. From their reports he produced in 1850 daily weather maps showing the trend of storms and other meteorological conditions. As interest increased in weather knowledge, the number of volunteer observers increased, and it became possible to foretell weather at specific localities. In 1857 Henry furnished weather indications to a Washington newspaper, and their publication met with such approval that the paper carried them every day.

The meteorological observations were seriously disrupted during the Civil War. Henry, in the 1865 Smithsonian Report, suggested the advisability of creating a governmental meteorological organization to carry on the work on a large scale, and in 1870 provision was made for

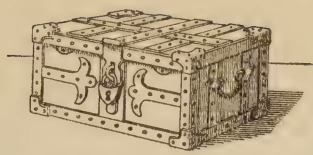
such an agency to be maintained by the Signal Service of the Army. Henry, in accordance with his principle of not expending Smithsonian funds for activities that could be as well carried on by other agencies, turned over to the Signal Service all the Smithsonian's data and transferred to it the system of volunteer observers. From the War Department's work there eventually arose the present United States Weather Bureau, and the Smithsonian was therefore in a sense the forebear of today's weather service.

Many other lines of work were taken up by the Smithsonian under Secretary Henry's guidance, most of them continuing in one form or another down to the present day. In 1850 he called in as Assistant Secretary Prof. Spencer Fullerton Baird, of Dickinson College, Carlisle, Pa., an authority in an entirely different field from his own—that of natural history. Under Baird's inspiration important work in zoology and botany was started by numerous scientists, both within the Institution and on the outside, with its assistance and cooperation. Henry initiated the system of International Exchanges whereby scientific and governmental publications are exchanged freely between this country and all the nations of the earth. This Smithsonian activity alone has been of incalculable benefit in stimulating the advance of science throughout the world. Henry and Baird together saw to it that the numerous exploring and surveying expeditions of the 1850's were provided with apparatus and directions for making collections in the unknown western parts of the country.

All these new activities looking to the increase and diffusion of knowledge brought about a notable upsurge in scientific progress throughout the country.

Upper, fossil skeletons of ancient extinct mammals in the U. S. National Museum. *Lower,* an alcove in the meteorite collection, U. S. National Museum.

Upper, Arts and Industries Building, and *lower.* Natural History Building, United States National Museum.



III

THE NATION'S TREASURE HOUSE

THE act of incorporation of the Smithsonian Institution contained provision for a museum and, to implement this provision, stipulated that "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens belonging . . . to the United States, which may be in the City of Washington, . . . shall be delivered to such persons as may be authorized by the Board of Regents to receive them." Even had this provision not been made, a museum would inevitably have arisen from the Institution's activities in the increase of knowledge, for such activities, particularly in the fields of anthropology, biology, and geology, entail the collection of specimens and their preservation for scientific study. It was, in fact, the mineralogical cabinet assembled by James Smithson for use in his own researches that formed the actual beginning of the present United States National Museum.

When Spencer F. Baird came to the Institution as Assistant Secretary in 1850 he brought with him his own large biological collections, and in 1861 the Institution received the very considerable assemblage of specimens brought together by the National Institute, a forerunner of the Smithsonian Institution, which included the noteworthy collections made by the United States Exploring Expedition of 1838 to 1842 under Lieutenant (later Admiral) Charles Wilkes. The early Government surveys of the new West and the work of the Fish Commission, established in 1871, added greatly to the growing museum, and all these accretions were capped in 1876 by the receipt of many of the American and foreign exhibits of the Philadelphia Centennial Exposition.

This flood of valuable specimens, constituting a record of American natural history and of the progress of the arts and industries, completely swamped the original Smithsonian Building, and Congress was petitioned for a separate museum structure. Appropriations were made available, and the present Arts and Industries Building was completed and occupied in 1881. This building, just before its completion, was used for the inaugural ball of President Garfield. By the close of the century, overcrowding again became acute. Congress was again appealed to, with the result that another building was provided—the Natural History Building, ready for occupancy in 1909. After World War I, a one-story steel structure built for war purposes was turned over to the Museum for the exhibition of the rapidly growing collection of historic aircraft.

Thus in the span of a century the museum provided for in the act of incorporation has developed from the original collection of minerals in the Smithsonian Building into the great United States National Museum comprising today many millions of specimens housed in three buildings of its own and in part of the parent Smithsonian Building. The whole presents a panorama of the natural history and anthropology of America and of the world, as well as of engineering, the useful arts, and history. It is high on the list of points of interest in Washington for the ever-increasing multitude of visitors to the Nation's Capital. In the last year before World War II, the annual count of visitors reached a peak of slightly over 2½ million. The educational value of the Museum's public exhibits, however, represents but a small part of its cultural worth, for the great study collections in biology, geology, and anthropology form the basis for a very large amount of fundamental research in these sciences, both by members of the staff and by accredited workers from other museums and research organizations and from universities.

In the beginning, when the museum was small and required little in the way of upkeep, the expenses connected with it were defrayed from the Smithsonian's own funds, but when the considerable National Institute collections were turned over to it in 1858, the small annual Congressional appropriation for the care of those collections came with them. Funds continued to be provided every year thereafter, and as the National Museum grew in size and completeness, it came to be

looked upon as a public necessity and the appropriations became progressively larger. Today Congress provides for a staff of curators to care for and study the collections, as well as for the necessary clerical and custodial forces.

The organization of the Museum has been adjusted with the growth of the collections. At present it comprises four major departments, each with numerous divisions; one independent division—that of history; and an administrative staff. Each department is directed by a head curator, each division by a curator, with usually an associate curator, an assistant curator, one or more scientific aids, and clerical personnel. The department of anthropology includes the divisions of archeology, ethnology, and physical anthropology; the department of biology, the divisions of mammals, birds, reptiles and amphibians, fishes, insects, marine invertebrates, mollusks and echinoderms, as well as that of plants, which administers the great United States National Herbarium with some two million plant specimens, making it one of the three largest herbaria in the world; the department of geology, the divisions of mineralogy and petrology, invertebrate paleontology and paleobotany, and vertebrate paleontology; the department of engineering and industries, the divisions of engineering, crafts and industries, medicine and public health, and graphic arts. The independent division of history administers not only the great collections of civil, military, and naval historical material, but also coins, medals, and stamps.

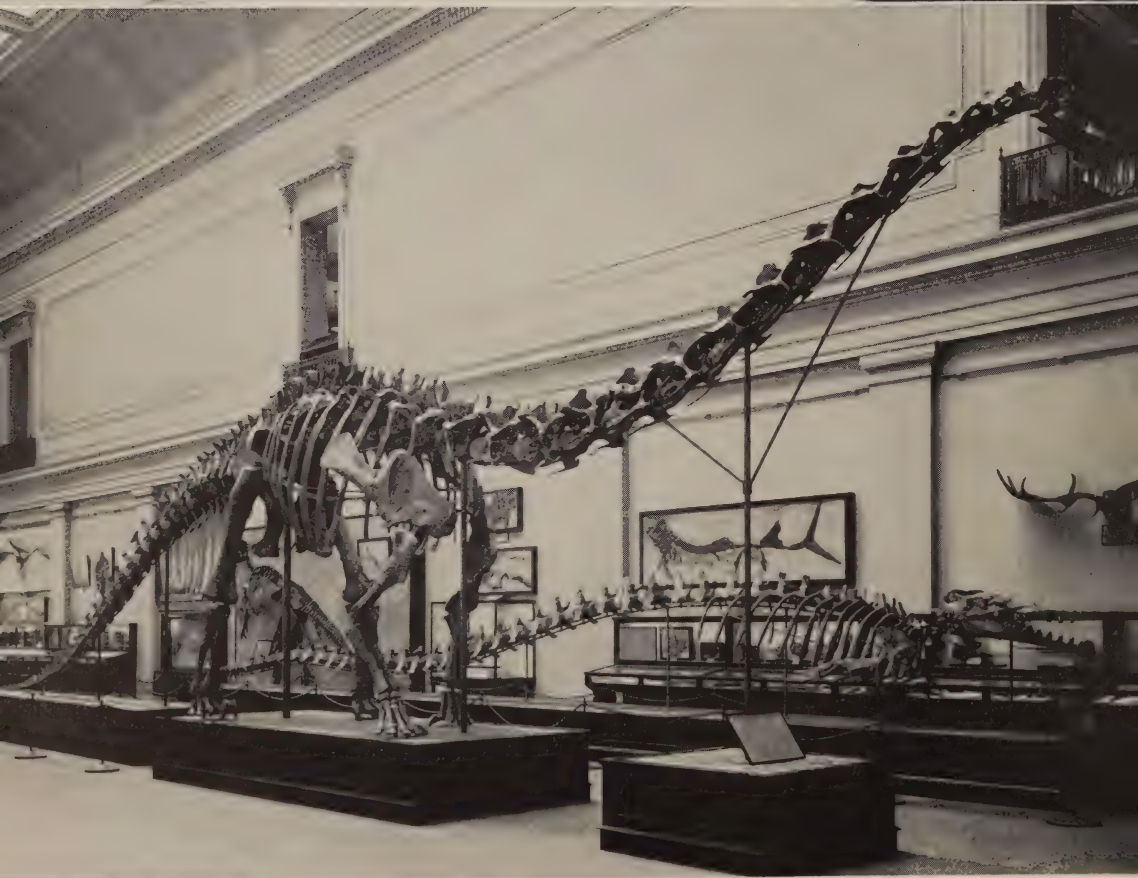
The responsibility of the scientific staff is twofold: each curator must care for and arrange the collections in his division, prepare some of them as appropriate public exhibits, and also conduct original researches on the much larger portion that constitutes the study collection. To the visitor, the public exhibits seem to be the important part of a museum, but the members of the scientific staff know that the soul of the museum resides in the systematically arranged study collections, where fundamental discoveries of new knowledge are constantly being made. Here new kinds of mammals, birds, fishes, insects, and many other life forms are discovered; minerals and meteorites are analyzed and described; the fossil bones of long-extinct animals are identified and pieced together to re-create the faunas of past geologic eras; and large series of human skeletal remains are subjected to standard com-

parative measurement. Many other types of basic research yield results of cultural and practical value to mankind.

These results are made known to the world in the Bulletins and Proceedings of the Museum, and the Contributions from the National Herbarium, a division of the Museum, as well as in numerous technical papers by staff members published in scientific journals. Distributed free to major libraries and educational and scientific institutions throughout the world, the National Museum publications stand as a tangible record of the Smithsonian Institution's labors for the increase and diffusion of knowledge. Because of the greater diversity of subject matter covered by the department of biology, papers in the various branches of that science have greatly predominated, although the other sciences have by no means been neglected. In the Proceedings and Contributions appear the descriptions of new species in all the major groups of animals and plants which come to light in the course of systematic study of the great National collections. As the specimen from which a new species is described becomes its type, the thousands of new forms described from the National Museum's collections have made the Museum in a sense a "bureau of standards" in the field of natural history, and one of the greatest of the national institutions of its kind in the world. In the Bulletin series are found the larger monographic studies of groups of animals of different kinds based on extended comparative studies, in the course of which it is often found necessary to make far-reaching revisions in the accepted classification and nomenclature of the group.

For visitors to the National Museum, the great assemblage of public exhibits make of it truly the treasure house of the Nation, for besides the things of obvious monetary value, there are also the priceless historical relics that serve to sharpen the focus of history in men's minds. Who could set a price on the original Star Spangled Banner that waved defiance from the ramparts of Fort McHenry during the attack of 1814? Or on George Washington's field kit used during the crucial campaigns of the Revolution? On the other hand, many exhibits have a very definite intrinsic value, as for example the great mineral collection, the largest and most complete in the world, including an outstanding collection of gem stones. The collections have been estimated

Upper, Hopi Snake Dance group in the U. S. National Museum. *Lower,* study collections and laboratory of the Division of Physical Anthropology, U. S. National Museum.



Upper, three-horned dinosaur *(Triceratops)* in foreground, skeleton and restored view of the primitive thin-backed reptile *(Dimetrodon)* in background. *Lower,* skeleton of the plant-eating dinosaur *Diplodocus,* 70 feet long.

to be worth more than $300,000,000, but of course their true value lies in their potentiality for increasing knowledge.

In the Natural History Building, the most popular exhibits are the Theodore Roosevelt collection of African animals, including giraffes, rhinoceroses, lions, and other animals native to that continent; the new habitat groups of moose, Rocky Mountain sheep and goats, and caribou; the beautiful bird exhibits; the reconstructions of dinosaurs, one of which reaches a length of 70 feet; the colorful minerals and gems, including the unique 12⅞-inch perfect crystal ball, the largest crystal quartz sphere known in the world; and the lifelike American Indian and other groups shown engaged in native occupations. The habitat groups are in the most modern manner, with rocks, bushes, and other features of the surroundings brought to the Museum from the native home of the animals shown, and with a painted background of the actual scenery. Plans are already formulated to extend this modernization of exhibits to other animal groups, as well as to the Indian tribal groups among the anthropological exhibits.

The best-known displays in the Arts and Industries Building, which also houses the American history exhibits, are the dresses of the Presidents' wives from Martha Washington to Mrs. Franklin D. Roosevelt; Lindbergh's *Spirit of St. Louis,* the plane in which he made the first nonstop solo flight across the Atlantic; historical relics of George Washington, Abraham Lincoln, Admiral Peary, and many other great Americans; the large series of early automobiles including the "Merrie Oldsmobile" of 1902, and the 1903 Winton which was the first to cross the United States under its own power; and the actual instruments or models of many important inventions, such as the telegraph, the telephone, the sewing machine, the cotton gin, the phonograph, and the typewriter. In the Aircraft Building are found many historic planes of outstanding interest, such as the Spad XVI flown by Gen. William Mitchell during World War I, the NC 4, first aircraft to fly the Atlantic, although not nonstop, and the *Polar Star* in which Lincoln Ellsworth flew across the Antarctic in 1935. There are also shown extensive exhibits illustrating the early development of aeronautics from the fantastic dreams of several centuries ago to the first actual achievement of controlled human flight by the Wright Brothers in

1903. The evolution of power plants for aircraft is depicted by a series of original engines.

By their very nature museums become cultural centers, and high among them stands the National Museum. Numerous scientific and cultural societies use its auditorium and rooms for lectures and meetings. Classes of school children come regularly to the Museum for supplementary instruction, not only from the District of Columbia, but also from the nearby States. Visiting scientists from other parts of the United States and from many foreign countries make extensive use of the great study collections, being accorded every facility for the prosecution of their investigations. The Museum library of more than 230,000 volumes, assembled primarily for the use of the scientific staff, is used regularly by students and investigators from other organizations. Members of the Museum staff are in constant touch through correspondence with scientists of other nations. The United States National Museum has come to be one of the world's leading scientific centers.

A large number of the Smithsonian field expeditions, described in another chapter, go out from the National Museum—in fact, in many Museum divisions the year may be divided into two parts, one devoted to field collecting, the other to office work and to laboratory study of specimens newly collected in the field with those already in the collections. A very considerable part of the National collections has resulted from these expeditions, for the curators are acquainted with the gaps that exist in their series and know what specimens are particularly needed in the investigations in progress.

The first director of the Museum was Spencer F. Baird, who brought with him his own large collection when he was chosen as Assistant Secretary of the Smithsonian Institution. He was succeeded by Dr. G. Brown Goode, who, when the first Museum building became available in 1881, reorganized the whole system of administration and exhibition. Goode was followed in turn by Dr. F. W. True, Dr. Richard Rathbun, W. deC. Ravenel, and the present director, Dr. Alexander Wetmore, who now is also Secretary of the Smithsonian Institution.

In size of staff and scope of activities the National Museum is by far the largest of the bureaus that have developed from the early work

of the Smithsonian Institution. Its researches and field explorations have contributed greatly to the "increase of knowledge," particularly of the natural history and anthropology of North America and other parts of the world, and its publications and exhibits constitute a major part of the Institution's achievements in the "diffusion of knowledge."

Primitive and advanced types of Indian dwellings. *Left,* Paiute lodge, Utah. *Right,* pueblo of Zuñi, New Mexico.

Four famous Indian chiefs. *Upper left,* Medicine Crow, Crow Tribe; *upper right,* Wolf Robe, Southern Cheyenne Tribe; *lower left,* Red Cloud, Oglala Tribe; *lower right,* Lone Tipi, Comanche Tribe. Photographs from the Bureau of American Ethnology's large collection of historic negatives of American Indians.

IV

INDIANS

ANTHROPOLOGY, the study of man himself, is for obvious reasons one of the most important as well as one of the most popular of the sciences. In this country there has always been a widespread and lively interest in the original race that populated America—the Indians. Morever, it is well known that a knowledge of aboriginal peoples is essential to a full understanding of civilized man's development, his psychology and sociology. It is not at all surprising, therefore, that prominent among the Smithsonian Institution's early activities was the scientific investigation of the Indian tribes of the United States. Much had previously been written about the tribes inhabiting various sections of the country, but the accounts were usually incidental parts of travel books and contributed little to an understanding of the race as a whole.

As in the fields of zoology and botany, the chance for a scientific approach to the problems of American ethnology came with the Government expeditions sent to explore the largely unknown West after the Civil War. The Institution had already published Squier and Davis' famous "Ancient Monuments of the Mississippi Valley" and a number of other works relating to anthropology, but when the various western surveys had assembled large amounts of new information on the Indians, and Congress in 1879 appropriated funds to continue anthropological researches under direction of the Smithsonian, the way was open to an organized study of the American aborigines.

Secretary Henry had in 1867 fostered the Rocky Mountains explorations of Maj. John W. Powell and 2 years later Powell's daring descent

of the Grand Canyon of the Colorado. Major Powell was a veteran of the Civil War, in which he lost his right arm, but in spite of this severe handicap he conceived and carried out the perilous plan of descending the length of the unknown Colorado in boats for the purpose of mapping it and studying the geological structure. With 10 men in 4 boats, each boat with water-tight compartments in bow and stern, the expedition started down the canyon in May 1869.

The dangers and hardships surpassed even what Powell had anticipated. In the granite sections, rapids and falls were almost continuous and the canyon wall was precipitous. In many places portage was impossible because of sheer rock walls that rose from the water's edge, and here there was no alternative but to run the rapids. The boats were frequently swamped or overturned, but the explorers always succeeded in clinging to the sides and climbing aboard again when calmer water was reached. The courage of four of the men failed and they left the party, three of them only to be killed later by Indians. Most of the provisions were spoiled through frequent wetting, instruments and collections had to be abandoned, floods rushed down the side gorges after every rain, but Powell and the remaining men went doggedly on until at last they came out of the canyon into smooth water below, and success had been achieved.

Explorations in the West were continued during the 70's with Major Powell in charge, and observations on the various Indian tribes encountered were considered to be a definite part of the duties of the personnel. In 1879 the Government surveys were consolidated as the United States Geological Survey, and the anthropological work thereafter stood alone as the Bureau of American Ethnology under the Smithsonian Institution, directed by the man most responsible for its creation, Major Powell. He visualized the new bureau as a clearinghouse for organized studies on the Indians by members of its own staff and collaborators, and he mapped out subdivisions of the science which could be more intensively studied and later coordinated into a logical body of knowledge.

The first classification of the numerous tribes was inspired by a very practical consideration—the necessity of grouping satisfactorily on reservations the more than 300,000 Indians who were in effect wards of the Government. After careful study it was concluded that language

afforded the simplest and most effective basis for classification. Some 50 linguistic families emerged, comprising more than 500 distinct Indian languages. Associated with language differences, of course, were also differences in beliefs, organization, customs, and arts. As soon as the classification of tribes was well along toward completion, Powell organized scientific studies of typical tribes in the various groups. Thus for the first time a systematic investigation of the American Indians was launched.

From that time more than half a century ago to the present day the Smithsonian Bureau of American Ethnology has studied the Indians, increasing our knowledge of every phase of their life in nearly every State of the United States, in most of the countries of South and Central America, in Mexico, and in the West Indies. During that period many of the smaller tribes have dwindled to but a few old individuals, or have disappeared, and in some instances valuable scientific information has literally been snatched from oblivion by recording the last words of dying survivors. Indian mounds to be inundated through the construction of dams have been excavated through Smithsonian cooperation, and knowledge of them and their contents preserved for posterity. The Bureau has seized every opportunity to get from the older Indians the authentic aboriginal rites, customs, and words that are no longer remembered by the younger generations. All through its history the Bureau has kept in mind the vital importance of recording ethnological material that is in danger of being lost forever.

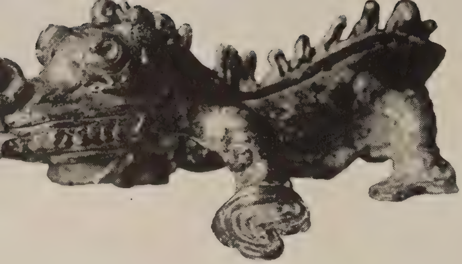
The Bureau's regular year-by-year work has included the systematic study of the language, customs, beliefs, myths, and organization of the numerous tribes throughout America. Its staff members and collaborators have worked among the numerous West Coast tribes, the peaceful Pueblos with their cultivated fields and aboriginal "apartment houses," the marauding Navaho and Apache of the Southwest, the warlike Sioux, Omaha, Mandan, and other tribes of the Great Plains, the Iroquois of the Northeast with their league of nations in the Stone Age of America, the Southeastern forest tribes, and many others from the snow-covered Arctic to the tropical jungles. From these widespread investigations has come a stream of publications that make a sizable library of Indian lore. Bureau publications have always been in great demand, not only by libraries and anthropologists, but also by the

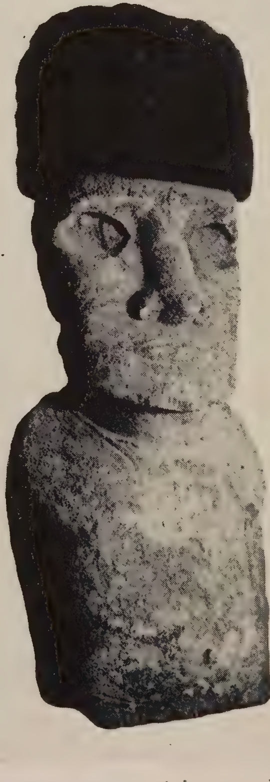
general public, for the "red man" has ever been of keen interest to all Americans.

Bureau ethnologists have obtained their information first-hand by going among the tribes to be studied and working directly with the best informants available. Often by patient diplomacy and by cultivating an understanding of the Indian mind the investigators were given access to secret rites and ceremonies never before witnessed by white men. Several staff members have been elected honorary members of certain tribes, and at least two Bureau ethnologists were themselves Indians and so had a twofold interest in the tribes they studied. In the field, language has been recorded phonetically, creation and other myths have been set down as recited by Indian informants, rites and ceremonies with all their pomp and paraphernalia have been observed and recorded, and the innumerable details of customs and ways of life have been noted—marriage and birth customs, initiation and puberty rites, taboos, house construction, hunting and fishing, war, sports and games, weapons, clothing, food, ornaments, and all other phases of Indian life as it was before the white man came to interrupt the development of their civilization.

The field season over, notes are brought back to Washington for study in the office. Here the material is organized and prepared for publication, the end result of any scientific investigation. In a number of instances the Bureau has undertaken to synthesize and coordinate the available knowledge in various phases of American Indian culture. The best known of these compendia is the famous Handbook of American Indians North of Mexico, edited by Frederick Webb Hodge, first printed in 1907-1910 and reprinted by order of Congress in 1913. It has now been out of print for many years but is available to students and others in all sizable libraries, as are all other Smithsonian publications. Manuscript for a completely new work to replace it is now in the editor's hands. Others are the Handbook of American Indian Languages, by Franz Boas; the Handbook of Aboriginal American Antiquities, by W. H. Holmes; Handbook of the Indians of California, by A. L. Kroeber; the Indians of the Southeastern United States, by John R. Swanton; and the very recent Handbook of South American Indians, a monumental work in five volumes, edited by Julian H. Steward.

Upper, Smithsonian expedition camp and excavations at the Lindenmeier site in northern Colorado. Here artifacts made by Folsom man were found in association with the bones of extinct animals. *Lower,* examples of Folsom points showing the characteristic shape and longitudinal fluting. They are probably 10,000 to 25,000 years old.





Indian sculpture, U. S. National Museum. *Upper left,* gold-plated ornament, Panama; *right,* carved stone seat, Nicaragua. *Middle left,* replica of a Maya altar, dancing figure at left, Guatemala; *right,* pottery incense burner, Mexico. *Lower left,* wood carving, panther god, Florida; *right,* stone statue (height, 10½ feet), Easter Island.

When the Bureau was founded, it was the intention to study exclusively contemporary Indian culture, which was evidently in danger of being gradually obliterated by the encroachment of the white man's civilization. But in a few years Congress stipulated that the Bureau should also give attention to the prehistoric remains of the Indians of former days. Since then, therefore, archeology has been a more or less prominent feature of the Bureau's work, and knowledge has been made available concerning many ancient Indian mounds, shellheaps, cliff houses, and other prehistoric works with their evidences of prehistoric cultures.

One of the latest of Smithsonian archeological studies is that of Folsom man, that mysterious early American whose handiwork has become well-known but whose skeletal remains have yet to be found. His culture is symbolized by a peculiar type of projectile point known as the Folsom point, whose chief characteristic is a longitudinal flake removed from each side. These have been found in many parts of the United States, and in Colorado a Smithsonian archeologist has excavated a large site showing evidence of occupation by Folsom man. The great age of these remains is attested by the direct association of Folsom points with the bones of animals long since extinct, as well as by geological studies of the Colorado site. Geologists date the finds at between 10,000 and 25,000 years ago, with their present preference leaning toward the higher figure.

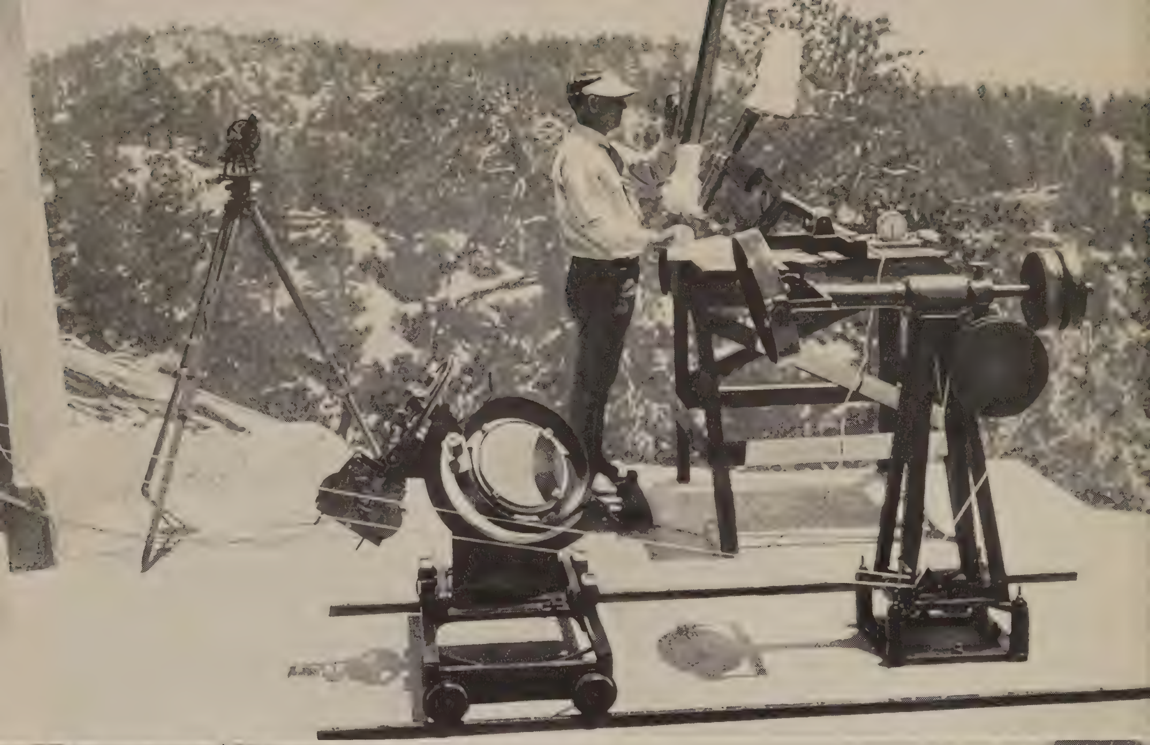
Equally important with the Institution's own work in ethnology and archeology is the part it has been permitted to play in coordinating and assisting in the work of other American agencies engaged in similar work. The Bureau of American Ethnology has for many years been looked upon as a clearinghouse and focal point for information relating to the American aborigines, and in this capacity it has been able to promote American anthropology in many ways, both tangible and intangible. Its investigations, furthermore, provide a sound basis for the intelligent administration of Indian affairs.

The founder and first Director of the Bureau, Major Powell, died in 1902 and was succeeded as Director by Prof. W. H. Holmes. When Holmes was appointed first Director of the National Gallery of Art (now the National Collection of Fine Arts), the Bureau was placed

under the direction of F. W. Hodge, who was succeeded in turn by Dr. J. Walter Fewkes and the present Director, Dr. M. W. Stirling.

The visible results of the Bureau's more than half a century of anthropological work are to be found in its publications. During that period it has issued 48 quarto Annual Reports, with accompanying scientific papers, and 143 octavo Bulletins, which altogether add up to nearly 70,000 pages of data on every phase of Indian life and culture. The publications vary in size from a 12-page discussion of Wyandot government, by J. W. Powell, in the First Annual Report, to Boas' monograph on the ethnology of the Kwakiutl, in the Thirty-fifth Annual Report, that extends to nearly 1,500 pages. They deal with Indian tribes in every section of the two American continents, as well as the natives of the Hawaiian Islands, and treat of every aspect of the Indian civilization—language, religion, myths, material culture, methods of warfare, tribal organization, and music, as well as of the physical anthropology of the Indians. The Bureau publications are distributed free to libraries and scientific and educational institutions throughout the world. They form an impressive body of basic knowledge relating to the American Indian civilization.

Desolate region of Mount Montezuma, Chile, where Smithsonian solar observing station is located. Observers' quarters at left; observing station near top of peak from which picture is taken.



Upper, measuring the radiation of the sun at the Smithsonian observing station on Table Mountain, California. *Lower*, Smithsonian observing station near the top of Mount Montezuma, Chile.

V

LIFE DEPENDS ON THE SUN

ON lonely mountain peaks on two continents Smithsonian observers record the day-by-day variation in the radiation coming to us from the sun. When we stop to consider that the energy riding the solar rays is responsible for all life on this earth from the lowest type of plant to man himself, for seasons and climate with their storms and droughts, and basically for all man's industries through the stored energy in oil and coal, the importance of studying the sun becomes obvious. As far back into the mists of antiquity as we have any record of man's thoughts and activities, the sun was looked upon with reverence and awe—in fact, was worshiped as a god in many lands. But only in comparatively recent times has the attempt been made to study the sun from a strictly scientific point of view. We now have a considerable body of recorded knowledge as to its composition, temperature, spectrum, and radiation, no small part of which has come from the researches of the Smithsonian Astrophysical Observatory.

The Observatory stands today as a monument to Samuel Pierpont Langley, third Secretary of the Smithsonian. He conceived the idea, obtained Congressional support as well as private funds, outlined the nature of the investigations to be made, and himself conducted notable researches on the sun. Astronomy along with other sciences had reached a turning point about Langley's time. He himself described the change as follows:

"The prime object of astronomy until lately has been to say *where* any heavenly body is, rather than *what* it is, but within the present generation a new branch of astronomy has arisen, which studies the heavenly bodies for what they are in themselves and in relation to ourselves. Its study of the sun, for instance, beginning with its external features, led to the inquiry as to what it was made of, and then to the finding of the unexpected relations which it bore to the earth and to our daily lives on it, the conclusion being that in a physical sense it made us and recreates us, as it were, daily, and that the knowledge of the intimate ties which unite man with it brings results of a practical and important kind which a generation ago were hardly guessed at."

Professor Langley is probably best known for his pioneering investigations in the field of aeronautics. He devoted years to painstaking experiments designed to establish basic facts in a subject so new that it was not even looked upon as a legitimate science. Although he never succeeded in getting his man-carrying plane to ride the air, nevertheless he contributed greatly to the advancement of aeronautics through his original investigations and publications, and his successful flights of large-sized steam-powered models, which flew without a pilot more than half a mile as early as 1896. His name is commemorated in the great Langley Field in Virginia and in the Langley Memorial Aeronautical Laboratory located there.

The Astrophysical Observatory began its work in 1890 with headquarters in a small frame structure erected for the purpose on the Smithsonian grounds. In it Langley constructed a spectrobolometer, which he had invented some years before, for the purpose of studying the spectrum of the invisible infrared rays of the sun, largely unknown up to that time. No attempt will be made here to describe this piece of research except to say that it was a delicate and difficult one, done under very unfavorable conditions. It is indeed remarkable that Langley succeeded in extending the infrared spectrum to 12 times that previously known. Langley's bolometer when perfected was capable of measuring a change of temperature of one-millionth of a degree.

Other investigations were undertaken at the Observatory, including one on light without heat, in which Langley showed that processes exist for the production of such light. However, the research that eventually came to be the chief concern of the Observatory was the measurement

of the intensity of the sun's radiation as it would be if observed entirely outside the earth's atmosphere. This measurement, an extremely delicate and complicated one, is known as the solar constant, although actually it has been found to vary considerably from day to day. Langley, realizing that the first requisite for good solar observations was clear air, made an expedition to Mount Whitney, in California, in 1881. Here in beautifully transparent atmosphere he made numerous observations and calculated a new value for the solar constant which stood for 20 years, until further refinements in observation served to correct it and establish a new value.

After the establishment of the Astrophysical Observatory, Langley and his assistants continued observations on solar radiation at Washington, although the atmosphere there was highly unsuitable. However, experience was gained and instruments were improved, and in 1905 the opportunity came to observe on Mount Wilson, Calif., at the invitation of the Carnegie Institution of Washington. The solar constant of radiation had from the beginning shown variation regardless of observing conditions, and from this time on the study and recording of this variation became a leading purpose of the work. In 1909 and 1910 observations were made at the summit of Mount Whitney, 14,500 feet high, and from then to the present day Smithsonian observers have occupied observing stations on high mountain peaks in many odd corners of the earth to check the variation in the sun's heat. Today observations are made regularly at three stations—Mount Montezuma, Chile; Table Mountain, Calif.; and Burro Mountain, N. Mex. Other stations used for a time and then abandoned for various reasons were Hump Mountain, N. C.; Mount Harqua Hala, Ariz.; Mount Brukkaros, Southwest Africa; and Mount St. Katherine, Egypt.

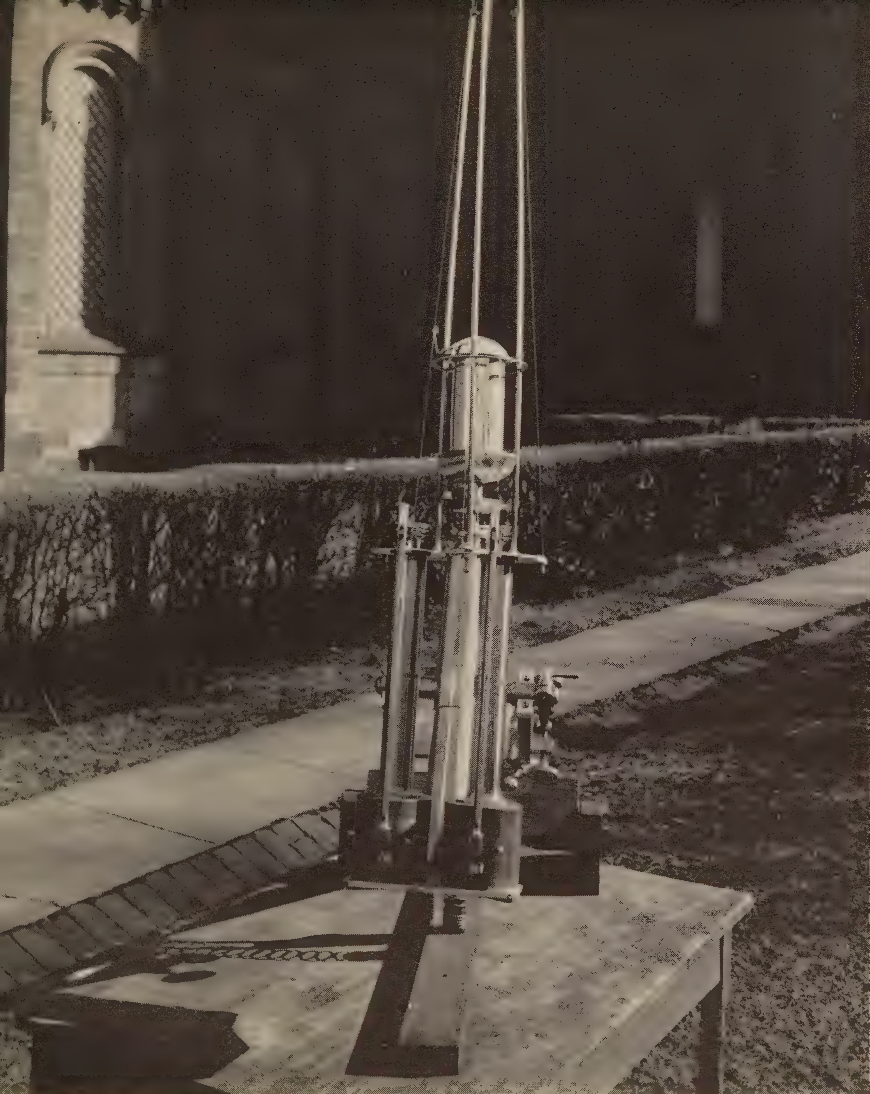
Langley's original method of observing the sun's radiation was very tedious and time-consuming, having the serious objection that but one measurement could be made in a day. After Langley's death in 1906, the direction of the work was taken over by Dr. Charles G. Abbot, who in 1927 was elected Secretary of the Smithsonian Institution and held that post until he retired in 1944. He still continues his scientific investigations as a research associate. Dr. Abbot's enthusiasm for solar

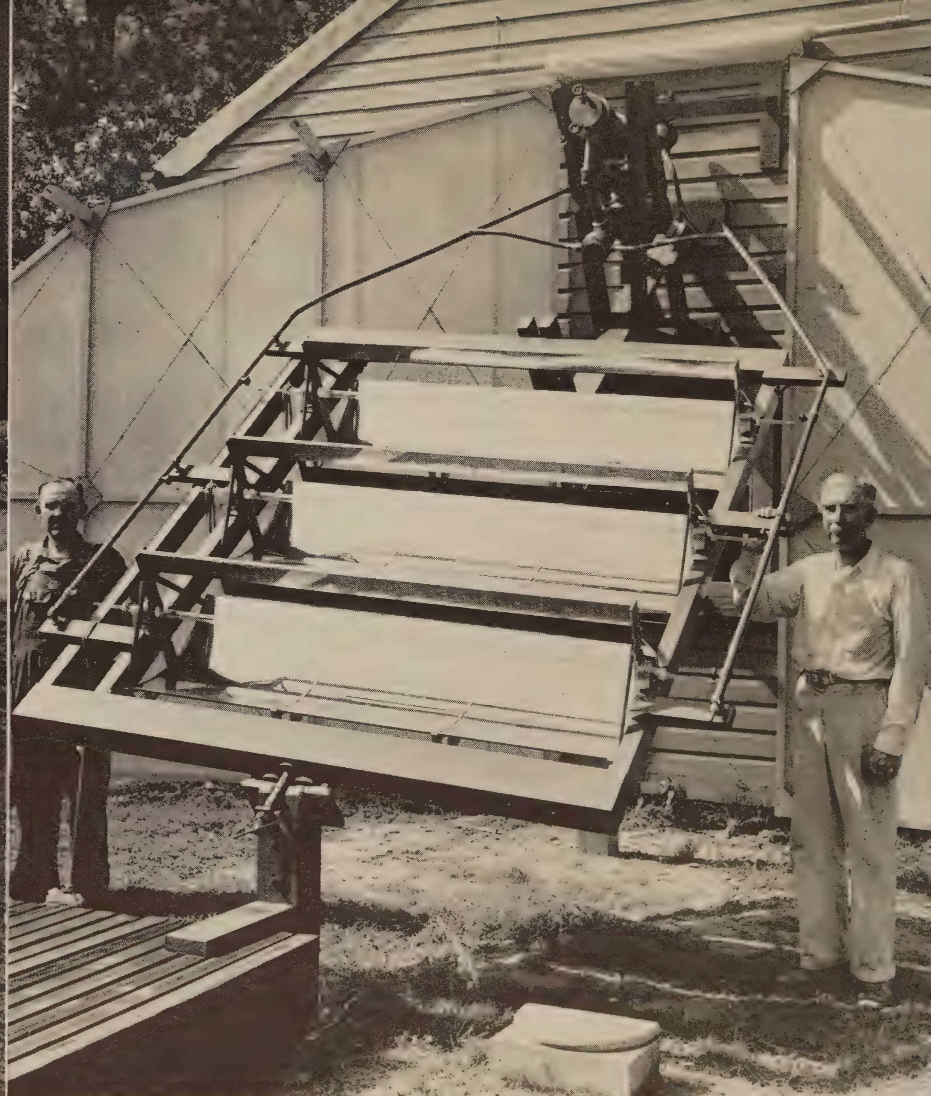
research equaled Langley's, and he has greatly advanced the study along many lines. The various instruments used at the solar observing stations have been vastly improved and new ones have been added. As instruments and methods improved, the time required for observing and computing decreased until now five complete observations and computations can be made in 4 hours. The result is apparent in far more reliable values of the solar constant, and consequently greater reliance on any investigations based on them.

Briefly the procedure for each observation of the solar radiation is as follows: With the pyrheliometer, an instrument developed by the Astrophysical Observatory, the total intensity of the sun's rays is measured in calories per square centimeter per minute. At the same time the sun's altitude is observed with a theodolite to determine the length of the path of the sun's rays in the atmosphere. With a bolometer the intensities of the different wave lengths composing the sunlight are observed. Then by the use of various formulae and correction factors, the value of each observation is computed as it would have been had it been made outside the atmosphere.

The observers who man the Smithsonian stations on mountain tops in Chile, California, and New Mexico need to have very special qualifications. The work itself requires painstaking skill and devotion to science, and the isolated localities occupied call for self-reliance, stamina, and sustained cheerfulness. The solar-constant values, which they compute on every suitable day, are sent in to the Washington headquarters at the Smithsonian, where they are analyzed and tabulated. About every 10 years the Observatory has published a volume of Annals, recording the details of the research work and the results. The latest of these, volume 6 issued in 1942, contains a 77-page, 12-column table summarizing the Observatory's solar-radiation data for the period 1923 through 1939.

Thus, as the result of Smithsonian astrophysical research in the field and at the home office, there are available to the world almost daily values of the sun's radiation since 1923. Even were these records not of immediate usefulness, they would be of incalculable interest and value to future generations, not only for use in various researches, but also as indicating whether the sun's heat is increasing or diminishing over the centuries. Dr. Abbot has long been a student of periodicities





Left, combination of instruments used daily in solar-constant observations. The two lower instruments are silver-disk pyrheliometers for measuring total solar radiations. The upper one is a pyranometer for measuring the brightness of a known area of sky around the sun. *Right*, one form of Dr. C. G. Abbot's solar heat collector. Dr. Abbot at right.

Upper, measuring the intensity of the sun's radiation with a Smithsonian pyrheliometer. *Lower,* experimental arrangement of light filters and gas chambers for investigating respiration and photosynthesis of small plants, Division of Radiation and Organisms.

in solar radiation and their correlations with variations in weather, offering promise of the possibility of long-range weather forecasting.

Although the solar-constant research has been for many years the major activity of the Astrophysical Observatory, many related studies in the field of astrophysics have been carried forward. Among these should be mentioned investigations on the distribution of energy over the sun's disk, the radiation of the earth to space, the quantity of water vapor in the atmosphere, the infrared solar spectrum, and the spectra of the stars.

Upon Dr. Abbot's retirement in 1944, Loyal B. Aldrich, Assistant Director of the Observatory for many years, became its Director. He had collaborated closely with Dr. Abbot in the solar investigations, and the work continues along similar lines under Mr. Aldrich's guidance.

Another field of investigation of much popular interest and of great potential value for the future is that of the utilization of solar power. The solar energy available in desert regions of the earth is many times the entire world's present power requirements. In future years when coal and oil are not so plentiful and cheap as they are at present, this solar energy may be called upon to replace present sources of power. Dr. Abbot has devised several types of solar heat collectors that convert solar energy into useful work. One type consists of cylindric mirrors which focus the reflected sun's rays upon glass tubes. The tubes are filled with a black liquid to absorb and store the heat for solar cooking devices, or to produce steam for developing power for mechanical purposes.

In 1929 a new type of research was inaugurated through the establishment of the Division of Radiation and Organisms. Supported at first by Smithsonian private funds and financial aid from the Research Corporation of New York, it has since been recognized as so valuable as to merit support by the Government and is now administered as a division of the Astrophysical Observatory. The new division investigates the effects of radiation of various types and of different wave lengths on living organisms, chiefly plants. The first few years of the division's activities were devoted to the assembling and developing of the extremely delicate and complicated instruments and apparatus needed for the research. Experiments were then begun on the

effect of various types of radiation on the growth of plants, and many interesting and valuable findings have come from these experiments. Like other phases of Smithsonian research, this work is fundamental in character and is not restricted to work of an immediately practical nature. The effort is to discover basic laws and principles, in the sure knowledge that all such discoveries will eventually be put to use in promoting the welfare of mankind.

The results of all these various lines of research have appeared in the publications of the Institution, notably the Annals of the Astrophysical Observatory, the Smithsonian Miscellaneous Collections, and the Smithsonian Annual Reports. Through its original investigations and the published results thereof, the Observatory has served notably in carrying out Smithson's wish for the increase and diffusion of knowledge.

VI

LIVE ANIMALS

ALTHOUGH a zoological park is an obvious means of diffusing knowledge in the field of biology, and thus would appropriately belong under the Smithsonian Institution, nevertheless the National Zoological Park, a branch of the Institution, came into being in a somewhat roundabout way. During the early development of the National Museum, another branch of the Institution, a collection of mounted animals was being assembled for public exhibition, and living animals of many kinds arrived at the Institution at intervals to serve as taxidermist's models. Although they were definitely incidental to the purpose at hand, the public learned of them and became so interested that Secretary Langley found it desirable to do something about it. A few animals were kept in temporary quarters on the grounds back of the Smithsonian Building, and although this proved unsatisfactory, the live-animal exhibit became so popular that a Department of Living Animals was created with William T. Hornaday, noted taxidermist and later conservationist, in charge. The collection continued to grow until it exceeded the 200 mark, and Professor Langley began to think in terms of a large wooded area where animals could be shown in something like their natural habitat. Several American mammals, most conspicuously the American bison, or buffalo, were at that time in grave danger of becoming extinct, and Langley felt that such a sanctuary might serve to prevent such a catastrophe.

There immediately came to mind the beautiful valley of Rock Creek, now in the heart of Washington but at that time "out in the country"

and available for purchase at reasonable prices. Langley interested several members of Congress in the project, and in 1888 Senator Beck of Kentucky introduced a bill providing for the appointment of a commission to select a tract of land for a zoological park. It failed of passage, but the following year Senator Edmund's similar bill did pass, and, moreover, it contained an appropriation of $200,000 for the purchase of such land. The commission, which included Secretary Langley, wisely chose 175 acres in the most beautiful section of Rock Creek Valley. In November 1890 surveys were completed, and the site was turned over to the Government. In April 1890 Congress passed another bill putting the administration of the new park under the Smithsonian Institution and stating its purposes to be "for the advancement of science and the instruction and recreation of the people."

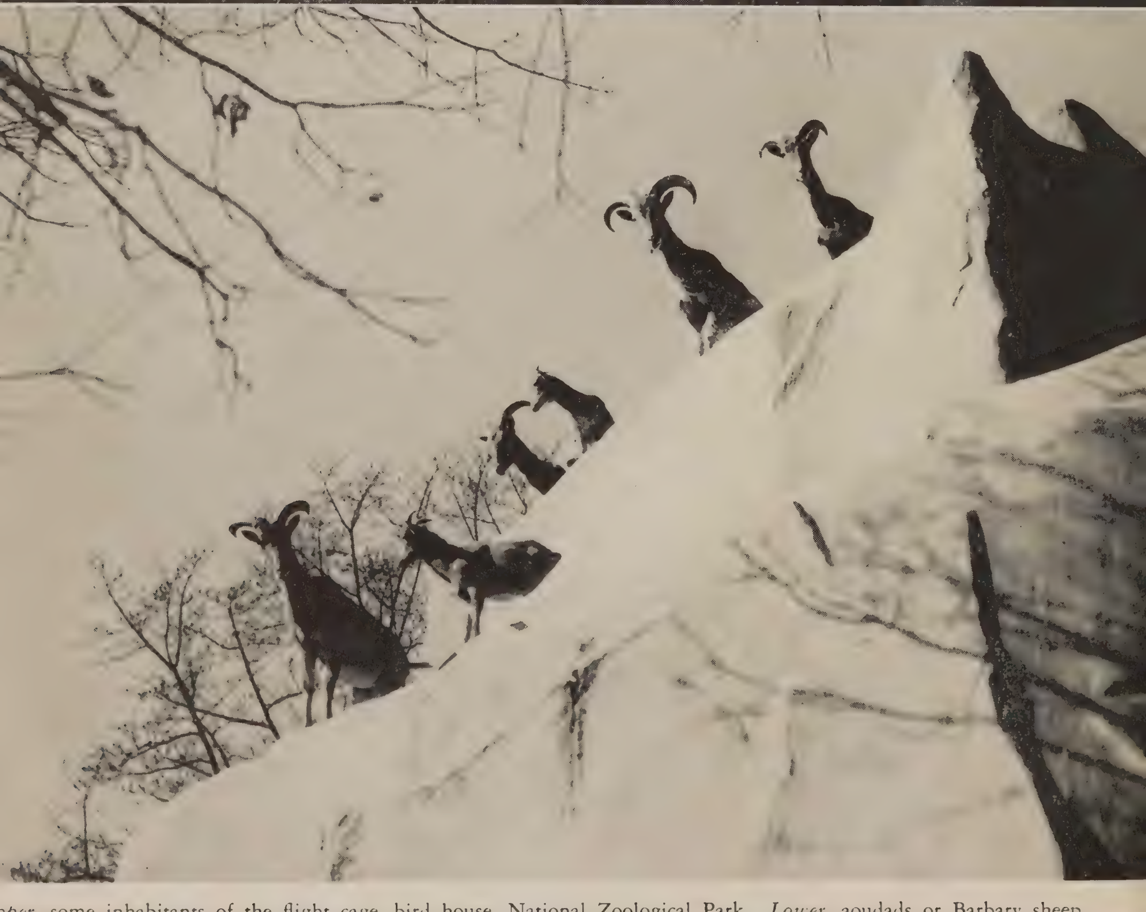
With rare foresight, Secretary Langley, instead of proceeding to develop the new National Zoological Park piecemeal with the limited funds available at the start, interested a world-renowned landscape architect, Frederick Law Olmsted, in drawing up a comprehensive plan for the entire future development of the project as a whole. With the orderly growth of the Park thus assured, a central area of 50 acres was selected for immediate occupancy, the rest being left in its state of unspoiled natural beauty. The necessary roads were constructed, the grounds were cleared and improved, and one animal house—all that could be attempted with the money available—was constructed. In a borrowed wagon, all the animals that had been kept in sheds back of the Smithsonian—some 185 strong—made the journey to their new home, and the National Zoological Park was opened to the public.

Man's keen interest in animals is perfectly natural, for they are his fellow travelers on this planet Earth. As far back into antiquity as history goes, there are records of menageries and animal preserves, in the early days chiefly reserved for the use and enjoyment of the rulers. Such records continue in increasing numbers down through the centuries to the present day, but gradually animal collections came to be available to the people generally. In this country zoological parks began to appear about 1860. In New York, Philadelphia, Cincinnati, and half a dozen other large cities, zoological gardens came into being before the Washington zoo became a reality. When the

European red deer in winter setting in the National Zoological Park. ((c) N.G.S. Reproduced by special permission from the National Geographic Magazine.)

Upper. American alligators in naturalistic tropical setting in the reptile house, National Zoological Park. *Lower*, Adele and jackass penguins in their refrigerated room in the bird house, National Zoological Park.

Cross section of the National Zoological Park's population. Reading down: *left row*, harpy eagle, American alligator, and Galápagos tortoise; *center row*, adjutant stork, giraffe; *right row*, douroucouli or night monkey, leopard, and Russell's viper



[Up]per, some inhabitants of the flight cage, bird house, National Zoological Park. *Lower*, aoudads or Barbary sheep on artificial mountain in National Zoological Park. (Photo by H. J. Cole.)

gates of the new National Zoological Park were thrown open, however, the public response was instant. From that time, more than half a century ago, to the present day, the yearly attendance at the Park has increased regularly, until now some two and a half million visitors enter the gates each year.

Although the recreation of the people is stated by law to be one of the aims of the Zoo—and doubtless a majority of the visitors do come largely for recreation—nevertheless the item of instruction also specified by law is not neglected. Actually those who come for recreation receive unconsciously the most practical kind of instruction in general zoology through observation of the habits, food, and distinctive features of the various kinds of animals. But, more significantly, hundreds of organized groups of students, totaling thousands of individuals each year, come to the Zoo with their teachers as a definite part of their school work. Art students find animal subjects most helpful in their work, and every year many of them come to the Park to sketch. Taxidermists, too, make studies of the living animals in order to mount museum specimens in authentic attitudes.

From the original nucleus of 185 animals, the national collection has grown year by year until in this 100th year of the Smithsonian Institution, the total population of the Zoo is over 2,600. Animals come to the Zoo in various ways—by purchase, through exchanges with other zoos, by gift, by natural reproduction, and as the result of field expeditions sent especially to bring back live animals. Purchases by the National Zoo are not numerous because of its limited funds for this purpose, but occasionally a rare animal needed to fill an obvious gap in the exhibitions is thus obtained from the animal dealers. Births in the Zoo and exchange of animals are closely related means of accretion: if the creatures born or hatched are needed to augment the existing showing, they are kept; if not, they are exchanged with other zoos for animals that are lacking in the collection. Gifts and transfers of animals are numerous. They come from Government officials from the President down, from other governments, from American consuls in foreign lands, and from many citizens who acquire animals in various ways—often as young individuals which soon grow too large or too dangerous to keep as pets.

Probably the most satisfactory method of acquiring new animals,

however, is by means of expeditions sent out especially to get what is wanted. Through the generous financial aid of several friends of the Park, it has been possible to send out or participate in a number of such expeditions. The first was that of former President Theodore Roosevelt, who went to British East Africa in 1909 to obtain natural history material for the National Museum and to be on the lookout for animals for the Zoo. Through his efforts an excellent small collection, including five lions, was obtained. In 1921 and 1922 Dr. W. M. Mann, now Director of the National Zoological Park, accompanied as naturalist the Mulford Biological Exploration of the Amazon Basin and brought back for the National Zoo a considerable collection, including numerous unusual species. In 1926 came the first major expedition solely for the purpose of collecting live animals for the Zoo—the Smithsonian–Chrysler Expedition to Tanganyika, East Africa. Well-equipped and well-staffed, this enterprise, directed by Dr. Mann, was eminently successful and brought back safely to Washington a large and varied assortment of animals to the number of 1,600, including giraffes, gnus, antelopes, monkeys, leopards, and many other kinds.

The National Geographic Society financed an expedition to collect animals for the National Zoo in the East Indies in 1937, again led by Dr. Mann. This expedition, too, was successful in acquiring many desirable additions to the Zoo's population, the acquisitions including 46 species of mammals, 93 of birds, and 34 of reptiles and amphibians. Localities worked in or represented among the collections were India, Java, Sumatra, the Moluccas, New Guinea, and Siam. Dr. Mann visited Argentina in 1939 for the sole purpose of acquiring for the Zoo a collection of South American animals. Through the cooperation of zoos, fur farms, and other organizations and individuals in that country he soon assembled a valuable assortment of local mammals and birds to the number of 316 specimens, including guanacos, llamas, capybaras, pampas cats, Brazilian tapirs, and many interesting birds.

The latest expedition was that to Liberia, West Africa, in 1940, financed by the Firestone Tire & Rubber Co., directed by Dr. Mann. Four separate trips were made into the interior, where animal drives netted many desirable specimens. Altogether, 195 individuals representing 61 species came to the Zoo as a result of this expedition.

Among them were chimpanzees, pygmy hippopotamuses, civets, duikers, a potto, a baboon, pythons, cobras, and several kinds of vipers.

Thus the National Zoological Park has grown from a very small aggregation of miscellaneous animals to a well-rounded collection whose numbers would compare with the number of people in a fair-sized town. The present population of over 2,600 creatures is made up of 677 mammals of 209 different species, 909 birds of 322 species, 447 reptiles of 105 species, and smaller numbers of amphibians, fishes, insects, and arachnids.

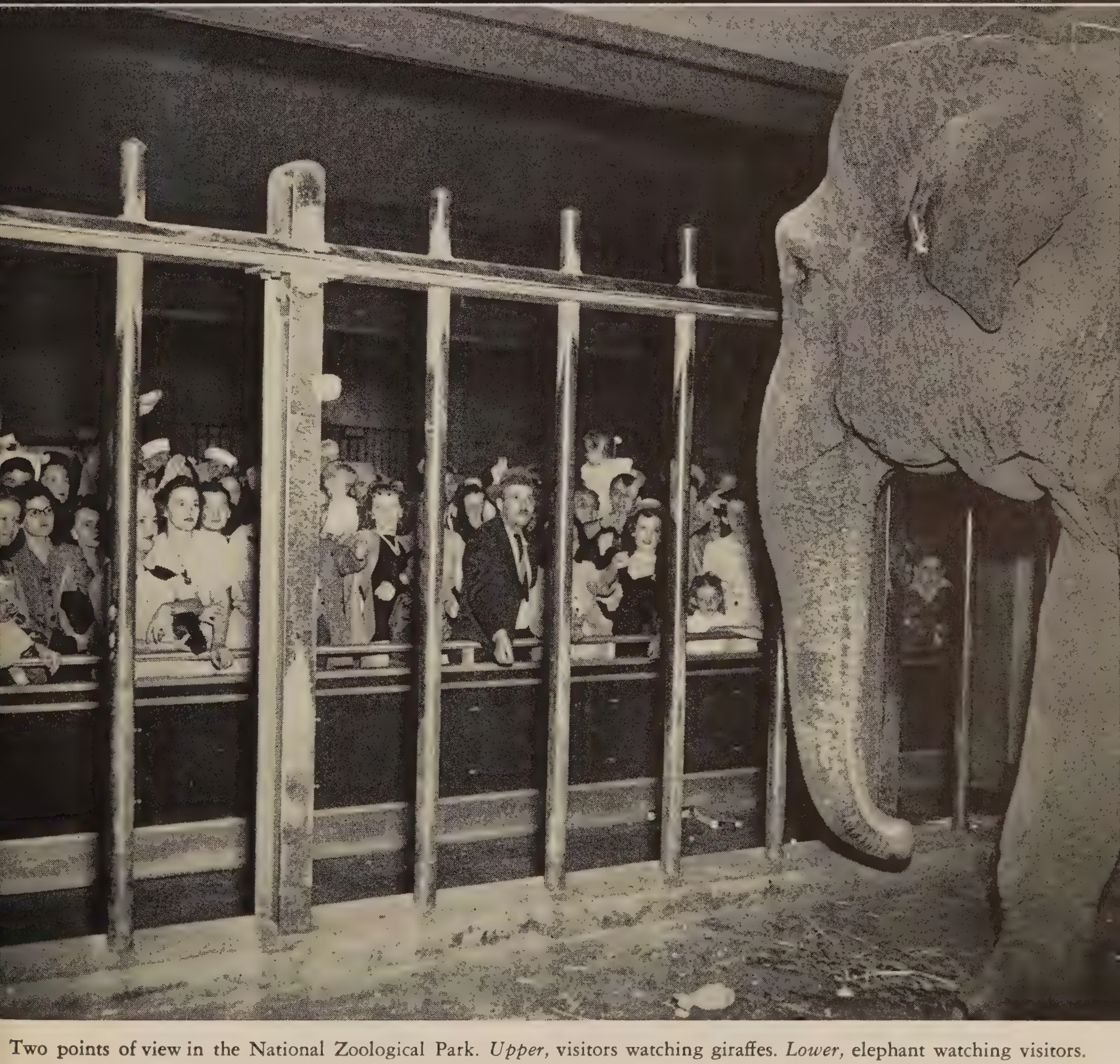
Among the inhabitants are all the well-known creatures that a large zoo would be expected to exhibit, such as monkeys, lions, tigers, bears, and elephants, but the National Zoo also has many of the rarer animals that are not so frequently seen in captivity. Among the more important of these latter are a herd of five Nubian giraffes, four of them brought back by the National Geographic Society Expedition, the fifth born in the Zoo; an Indian rhinoceros, gift from the Forestry Department, Government of Assam, British India; pygmy hippopotamuses, the earlier ones received through President Coolidge and Harvey Firestone, Sr., and fresh blood brought in by the recent Smithsonian–Firestone Expedition to Liberia; and three emperor penguins received as a result of the last United States expedition to the Antarctic. The longest an emperor penguin had ever previously lived in captivity had been 12 weeks; the three at the Zoo have now been there 5 years. The Zoo's herd of some two dozen American bison, or buffalo, which has maintained itself for years, is the outgrowth of Langley's plans for saving that animal from threatened extinction.

As the population grew, the physical equipment of buildings, paddocks, ponds, and other features of a large zoo have also expanded until today the National Zoo ranks among the finest in the country. The first buildings at the Zoo were more or less makeshift structures built from wholly inadequate funds and through necessity housing animals of widely diversified habits and requirements as to light, heat, and space. This unsatisfactory condition continued until 1926, when appropriations were made available for a splendid modern bird house and extensive outside cages for birds. In 1929 this building was matched by an equally imposing and well-adapted structure for reptiles,

which since its formal opening has become the most popular building in the Park.

In the 1930's the Zoo received a bonanza through the medium of the Public Works Administration which made possible a whole group of much-needed structures. A new wing was added to the bird house, and other construction included a modern building for pachyderms and other large animals, one for small mammals and great apes, a modern machine and carpenter shop, a central heating plant, and a new public restaurant seating 350 people.

The National Zoo has had four directors since its inception: Dr. Frank Baker, Ned Hollister, Dr. Alexander Wetmore (now Secretary of the Smithsonian Institution), and Dr. W. M. Mann, the present Director, all of them noted biologists. All have given their best efforts to make the Zoo a credit not only to the Institution, but to the Nation as well, for it is in very fact a "national" organization. Its financial support comes from Federal appropriations, many of the animals in the collection come through transfers from Government officials and departments, and a very material percentage of its two and a half million visitors each year is made up of individuals from outside the District of Columbia. Periodic checks of the license tags of automobiles in the Park show that every State in the Union is represented regularly among the visitors, and that the percentage of such "foreign" tags is not inconsiderable. Park officials keep constantly in mind the purpose of the National Zoo as defined by Act of Congress more than 50 years ago, namely, "the advancement of science and the instruction and recreation of the people."

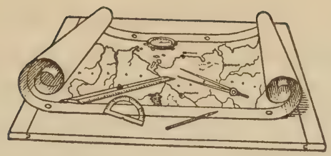


Two points of view in the National Zoological Park. *Upper,* visitors watching giraffes. *Lower,* elephant watching visitors.

Upper. Hood seal captured by members of the late Capt. Robert A. Bartlett's 1939 expedition to the waters around Greenland. *Lower.* the islet of San Gabriel, Dominican Republic. A Smithsonian expedition in 1928 found remains of the ancient cave dwellers of this region in the two caves at the left and right extremities of the island.

Upper, Smithsonian expedition camp in the Bridger badlands area north of Lone Tree, Wyo. Here was unearthed the fossil skeleton of an uintathere, a large mammal with six horns and saberlike tusks. *Lower*, method of removing plaster-encased blocks of fossil horse bones from Smithsonian expedition quarry in Idaho.

Upper, the trawl is about to go over on the Johnson–Smithsonian Expedition to the Puerto Rican Deep in 1933. Eldridge R. Johnson's yacht *Caroline* was specially equipped for marine studies. *Lower*, the Smithsonian–Hartford Expedition of 1937 sailed in the *Joseph Conrad* for marine biological exploration of the Caribbean area.



VII

EXPLORING FOR SCIENCE

IN these days of atomic energy, electronics, jet propulsion, television, and similar spectacular scientific achievements, the public is likely to get the impression that nearly all science is physical science. It should not be forgotten, however, that to achieve anything like a mastery of nature, mankind has need also of the natural sciences—biology, geology, and anthropology—and that these sciences, too, although not so often in the headlines, have made tremendous strides in recent decades. The Smithsonian Institution is proud to have taken part during its first hundred years in the advancement of these basic sciences, which have brought to man a constantly better knowledge of the earth and its inhabitants past and present. In these particular sciences exploration plays an important role.

Scientific exploration has but a single primary purpose—the acquiring of new knowledge. An expedition may go no more than 50 miles away, or its objective may be an untrodden jungle thousands of miles from headquarters, but the basic purpose remains the same—to acquire new information in the field or to collect specimens for later study in the laboratory. Smithsonian explorations started almost with the founding of the Institution in 1846. It has not sent out many large-scale expeditions—rather the purpose of exploration has been accomplished through numerous small-scale exploring parties sent out for specific objectives. Occasionally, however, through the financial aid of friends of the Institution, large Smithsonian expeditions have taken the field with outstanding results.

In the great hall of the Smithsonian Building in Washington is a large map of the world on which yellow dots indicate the location of a good part of the expeditions in which the Institution has been repre-

sented up to the year 1940. This map portrays strikingly not only the great number of expeditions in which the Institution has had a part, but also their world-wide coverage. Every continent is plentifully sprinkled with dots, as are also the major island groups of all the oceans; nor have the smaller and less well-known islands and island groups been neglected. The exact total of Smithsonian expeditions from the date of its establishment could be determined only by an unjustifiably long search of records and reports. From 1910, however, a fairly accurate total may be obtained from the annual "Smithsonian Exploration Pamphlets," published every year between 1910 and 1940. During that 30-year period, these pamphlets show that the Institution sent out or took part in 709 field expeditions. It is perfectly safe to say that the preceding 64 years of Smithsonian history would account for at least an equal number of expeditions—probably there were actually a great many more—so that a total of 1,500 is undoubtedly a very conservative estimate.

Although, as stated, every continent and large island group has been visited by numerous Smithsonian expeditions, yet for geographic reasons South and Central America, the West Indies, and Alaska have been most intensively explored, and of course every State in the United States has seen one or more Smithsonian field parties. Among the remote localities explored scientifically may be mentioned Antarctica, New Guinea, Borneo and Celebes, Midway Island, Wake Island, Siam, Kashmir, Siberia, Mongolia, the Aleutian Islands, Greenland, Algeria, Liberia, Tanganyika, Patagonia, the Galápagos Islands, and Easter Island. Every conceivable type of terrain has been visited and studied —high mountain tops and underground rivers, rugged "badlands" regions and the endless rolling prairie, perpetually frozen Arctic sites and the gleaming sands of tropical atolls, desert wastes where life is virtually nonexistent and the rank growth of sodden rain forests. All these varied aspects of the earth's configuration have yielded up grist for the mill of science. Tangible evidences of Smithsonian explorations in all parts of the globe may be seen in the exhibition and study collections of the National Museum, and in the pages of Smithsonian publications.

As mentioned above, the Institution has given major attention to the sciences of biology, geology, and anthropology, and in all these

field work plays a major role. In number of expeditions biology has probably predominated, especially in foreign regions, because the two major branches of biology—zoology and botany—depend very largely for their "raw material" on field collections. Large biological collections came from the numerous Government surveys of the little-known West of the 1850's, and the Smithsonian Institution had some part—large or small—in almost every one of these important explorations. Later came the intensive exploration of the American sea coasts, lakes, and rivers by the Fish Commission, a Government agency created by Congress largely through the initiative of Spencer F. Baird, then Assistant Secretary of the Smithsonian, who served for many years as its director without additional compensation. Through its close association with the Commission, the Institution took some part in these explorations and received extensive collections as a result of them.

Probably during very few years in Smithsonian history has the Institution failed to send out or be represented in a number of expeditions in the interests of biology. It would obviously be impossible here to attempt any sort of catalog of these expeditions or those in other branches of science—all that can be done is to mention a few typical ones. In 1909 there went out the Smithsonian–Theodore Roosevelt African Expedition which brought back for the National Museum a large and unique collection of the interesting animals of the Dark Continent. On exhibition in the Museum, these animals have ever since been one of the most popular features of the Natural History Building. In 1912 Ned Hollister represented the Institution on the Harvard Expedition to the little-known Altai Mountain region of Asia, bringing back an almost complete series of the interesting mammals and birds of that wild, desolate area. Between 1912 and 1918, through the financial assistance of Dr. W. L. Abbott, H. C. Raven explored Borneo and Celebes, making biological collections of unusual value, as they filled many gaps that existed previously in the Museum collections. Dr. Waldo L. Schmitt, working under the Institution's Walter Rathbone Bacon Traveling Scholarship, devoted a large part of the years 1925-1927 to a study of the crustacean fauna of the South American continent. His explorations covered most of both coasts of the continent, and the resulting collection contained more than 15,000 specimens of marine life. In 1932, through the cooperation of

Eldridge R. Johnson in offering the use of his 280-foot yacht and in financing the expedition, Dr. Paul Bartsch conducted marine explorations in the Atlantic's greatest deep, the Puerto Rican Deep, where bottom hauls were made down to a depth of 3,200 fathoms. Very extensive collections resulted, besides many meteorological, physical, and chemical data. As stated above, these are merely arbitrarily selected examples of Smithsonian biological exploration to show the nature of the work.

Anthropology probably rivals biology in number of separate field expeditions, although in this science most of the work of the Smithsonian has been done in this country. Since the founding of the Bureau of American Ethnology in 1879, with the purpose of continuing ethnological researches among the American Indians and the natives of Hawaii and the excavation and preservation of archeologic remains, every year has seen the departure from Washington of several members of the Bureau staff to engage in field work among the living representatives of the various tribes or on the prehistoric evidences of vanished tribes. A sampling of Bureau reports indicates that six such expeditions a year would be a very conservative average, which multiplied by the 67 years of the Bureau's existence would give a total of more than 400.

For the Smithsonian as a whole, there must be added to this number the expeditions taken part in by the anthropologists of the National Museum's staff, as well as the anthropological field projects organized by other institutions in which the Smithsonian had some part. Every section of this country has been worked—perhaps especially the southwestern and southeastern portions of it—and Smithsonian anthropologists have led or taken part in numerous expeditions to Mexico, South and Central America, the West Indies, and Alaska, as well as more remote regions such as the East Indies and other islands of the South Pacific, various parts of Europe and Asia, and the island groups lying between Alaska and Siberia.

The number of Smithsonian geological field expeditions has been somewhat smaller than that in the two sciences previously mentioned, doubtless because the United States Geological Survey has so ably carried on field work in this country. The Institution has, however, always been active in the fields of paleontology, mineralogy, and

Upper, view across Bering Strait from Cape Prince of Wales, Alaska, the westernmost point of America. At the extreme right is East Cape, Siberia, only 56 miles away. *Lower,* excavations at old Eskimo site at Cape Prince of Wales by the National Geographic Society–Smithsonian Expedition of 1936.

Mount Assiniboine in the Canadian Rockies. Dr. C. D. Walcott called this peak the Matterhorn of America. The Assinibone massif was the scene of some of Dr. Walcott's work in Cambrian geology, and here he located the line of demarcation between the Lower and Middle Cambrian formations.

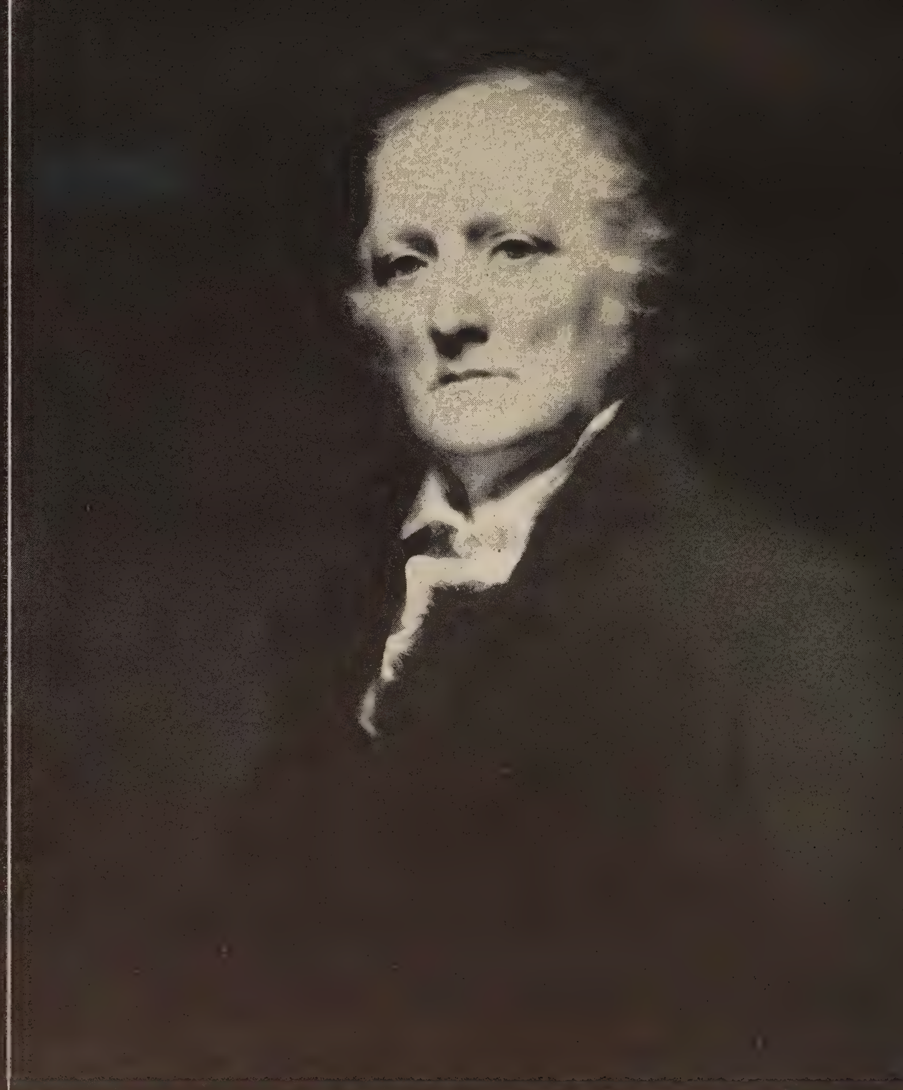
petrology, in all of which field work is a necessity. Best known of the Smithsonian's paleontological work in the field is that conducted for many years by Dr. Charles D. Walcott, fourth Secretary of the Institution. His researches for a long period were in the difficult field of Cambrian and pre-Cambrian geology and paleontology, and at the time of his death one of his professional colleagues wrote of him that 70 percent of our knowledge of the ancient Cambrian life forms was due to Walcott's work. His yearly field work was done mainly in the Canadian Rockies, where he discovered many excellent outcrops of Cambrian formations and collected and described numerous new fossil genera and species. Many small-scale expeditions have taken the field in this country to study and collect the fossil remains of creatures of past geological eras, and their success is attested by the extensive exhibition and study series in the National Museum of both vertebrate and invertebrate animals of the past. Mineralogy, also, has benefited from numerous small Smithsonian expeditions, both in this country and in foreign lands.

The story of Smithsonian exploration is a difficult one to present in brief because of the wide variety of objectives and localities and the very large number of individual expeditions. Perhaps the best way to provide a glimpse of the scope and variety of this phase of Smithsonian activity is to present the titles of the investigations for a single typical year as reported on in the Institution's annual exploration pamphlet. The year selected as being more or less "typical" is 1930, and the list of field expeditions for that year is as follows:

Studying the Sun in California, Chile, and South West Africa.
Collecting Insects in the West.
Further Explorations for Mollusks in the West Indies.
Pursuing Microfossils on the Atlantic Coast.
Monacan Sites in Virginia.
Ancient Culture of St. Lawrence Island, Alaska.
Music of the Winnebago, Chippewa, and Pueblo Indians.
Explorations in Szechuan, China.
Continuation of the Fossil Horse Round-up on the Old Oregon Trail.
Further Investigations on Evidences of Early Man in Florida.
Fossil Hunting in the Bridger Basin of Wyoming.
Studying the Indians of New Mexico and California.
Collecting Silver Minerals in Ontario, Canada.

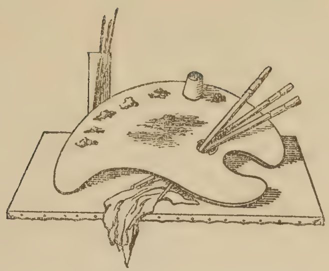
Field Researches among the Six Nations of the Iroquois.
A Botanical Visit to South and East Africa.
Anthropological Work on the Kuskokwim River, Alaska.
Arizona's Prehistoric Canals, from the Air.
Biological Collecting on "Tin-Can Island" in the South Seas.
Ancient Relatives of Living Whales.
Prehistoric Santo Domingan Kitchen-middens, Cemeteries, and Earthworks.
Studies of the Cheyenne, Kickapoo, and Fox Indians.
The Cruise of the *Esperanza* to Haiti.
The Search for Ancient Life Forms in the Rocks of the Western United States.
A Prehistoric Village on the Zuñi Reservation, New Mexico.
Trawling for Crustaceans at Tortugas, Florida.
Mounds of the Vanished Calusa Indians of Florida.
Archeological Reconnaissance in Texas and Nevada.
Indian Language Studies in Louisiana.
Afield with the Birds of Northern Spain.

Multiply this list by one hundred and it will be evident that the Smithsonian, acting alone and in cooperation with organizations of like aim, has literally combed the earth for new knowledge in the fields of natural science. James Smithson placed in his bequest no geographical boundaries or restrictions as to subjects of investigation, and Smithsonian explorations reflect this freedom of action, giving added significance to the motto selected for the seal of the Institution—Per Orbem, "Throughout the Earth."



Portraits in the National Collection of Fine Arts. *Left*, portrait of Miss Kirkpatrick, by George Romney, Harriet Lane Johnston Collection. *Right*, portrait of Archibald Skirving, Esq., by Sir Henry Raeburn, Ralph Cross Johnson Collection.

Freer Gallery of Art, Washington, D. C.



VIII

"A GALLERY OF ART"

ART may seem on first thought to be so far removed from the world of scientific research that the combination of the two under the administration of a single institution might appear incongruous. However, it must be remembered that James Smithson in his will placed no restrictions on the kind of knowledge he wanted increased and diffused. Art in its various manifestations undeniably constitutes a branch of human knowledge—indeed a very important branch as concerns the development of the esthetic, finer side of man's nature.

Recognizing this fact, the members of Congress who drafted the act of incorporation of the Smithsonian Institution included among the adjuncts of the Institution "a gallery of art." At the very beginning the gallery contained just two art works, one painting and one piece of sculpture, which had come to the Institution with Smithson's effects. From this minute nucleus, art under the Institution has developed and expanded until at the close of the first hundred years we see three distinct bureaus entirely devoted to it, with two splendid buildings and art collections that rank among the best in the world today.

With the development of the art feature in mind, the very first purchase made from the Smithsonian funds was the Marsh collection of prints, the foremost of its kind in America. Other small collections of paintings and other art works were added from time to time, but when the disastrous Smithsonian fire of 1865 destroyed the Stanley

Indian paintings which had been lent to the Institution for exhibition, the other art works were scattered among various buildings, and art at the Smithsonian remained dormant for many years.

This state of arrested development continued until 1906, when a small but valuable collection of paintings came to the Institution as a bequest from Mrs. Harriet Lane Johnston, niece of President Buchanan, who had bequeathed them to the National Gallery of Art when one should be established. A friendly court action instituted to settle doubtful clauses in her will resulted in the very important decision by the courts that the Smithsonian art collection legally constituted the National Gallery of Art. This event aroused immediate interest in the Nation's art collection, and before many years the chief problem, instead of the lack of art works, was the scarcity of suitable space to house the increasing collection. The name "National Gallery of Art" was changed in 1937 to "National Collection of Fine Arts," so that the former name could be given the collection and building presented to the Nation by Andrew W. Mellon, which will be described later.

The next and greatest increment to the Smithsonian treasures in art came through the gift of Charles L. Freer of his valuable assemblage of American and Oriental art, with provision for a separate building to accommodate it. Freer's gift to the Nation was followed shortly by that of William T. Evans, who presented to the National Collection a notable group of paintings by American artists. In 1916 Henry Ward Ranger left a bequest of $200,000, the income from which should be used for the purchase of art works which may be claimed under certain conditions by the National Collection. In 1919 came the Ralph Cross Johnson collection of 24 choice old masters, and in 1929 the John Gellatly collection of 1,640 items, including 164 paintings and drawings and many other types of art objects.

Although Congress has approved a site and plans have been prepared for a building for the National Collection of Fine Arts, funds have not yet been made available, and the Collection is still housed in temporary quarters in the Natural History Building of the National Museum. This condition has naturally slowed down the rapid expansion that followed the Harriet Lane Johnston bequest. No doubt the situation will be remedied in the not too distant future, and when an adequate separate building is available, the National Collection of Fine

Landscape in ink and faint colors on silk. A Chinese scholar's mountain retreat. Chinese, Sung dynasty, twelfth century A.D. (Freer Gallery of Art, 16.132.)

Ceremonial covered vessel of the type *kuang,* cast in bronze. Chinese, Shang dynasty, twelfth century B.C. (Freer Gallery of Art, 38.5.)

Arts, whose collections are already valued at many millions of dollars, will resume its normal growth.

Without doubt influenced by the Johnston bequest and the legal designation of the Smithsonian Institution as the National art gallery, Charles L. Freer, of Detroit, in 1906 gave to the Institution in trust for the American people his splendid collection of American and Oriental art objects and a gallery building to house them. The American material comprises probably the largest collection extant of the works of James McNeill Whistler in all mediums, plus paintings by other American artists. The Oriental material, by far the largest part of the Freer collection, consists of bronzes, sculpture, paintings, pottery, manuscripts, glass, metalwork, and other types of art works from the various countries of the Far and Near East. Mr. Freer described his purpose in assembling his collection in these words: "My great desire has been to unite modern work with masterpieces of certain periods of high civilization harmonious in spiritual and physical suggestion, having the power to broaden esthetic culture and the grace to elevate the human mind."

Besides his collection, Mr. Freer provided funds for a gallery building in the style of Florentine Renaissance palace architecture. The Freer Gallery, which was opened to the public in 1923, is situated in the Smithsonian Park just west of the Smithsonian Building. Even more important than the collection itself was Mr. Freer's recognition of art as a medium for the study of the cultures behind it, and for this he provided an endowment to be used not only for making additions to the Oriental collections but through them for the study of the civilizations of the Far East. He thus connected the work of the Gallery with research, which brings it even more into harmony with the primary function of the Smithsonian Institution.

The first Director of the Gallery was the late John Ellerton Lodge, who served until his death in 1942. He set the very high standards of administration, study of the collections, and new acquisitions which have been followed by his successor, Archibald G. Wenley, the present Director.

The Freer Gallery has published a number of works relating to the art of the Orient, the latest of which is an illustrated descriptive catalog, prepared by members of the staff, of the Gallery's outstanding collec-

tion of Chinese bronzes. A new series of Occasional Papers, started this year, will contain shorter papers resulting from the staff's continuous studies of the collections.

In 1937 Andrew W. Mellon gave to the people of the United States through the Smithsonian Institution his unexcelled art collection and a $15,000,000 gallery building, the whole to be known as the National Gallery of Art. Created as a bureau of the Institution, the Gallery is administered by a separate Board of Trustees, with four ex officio members—the Chief Justice of the United States, the Secretary of State, the Secretary of the Treasury, and the Secretary of the Smithsonian Institution—and five general trustees. The United States is pledged to pay the expense of the administration and operation of the Gallery, including the protection and care of the works of art. The building was completed and opened to the public in 1941, and since that time has proved to be one of the leading attractions in Washington.

Starting with Mr. Mellon's own collection of 111 choice old masters and 21 pieces of sculpture, the National Gallery collection has already grown greatly in size and importance through the gifts of several valuable assemblages of art works. Even before the official opening of the Gallery, Samuel H. Kress of New York gave his collection of Italian paintings and sculpture, pronounced by art experts to be one of the greatest private collections of Italian art in the world, and this was followed later by other gifts from Mr. Kress. The very valuable Widener collection was the next to be added to the Gallery, and in 1943 Lessing J. Rosenwald gave his collection of some 6,500 prints, increased later by additional items. With these and numerous other additions received as gifts, the National Gallery became from the start a center for the study of art in the United States and one of the great galleries of the world.

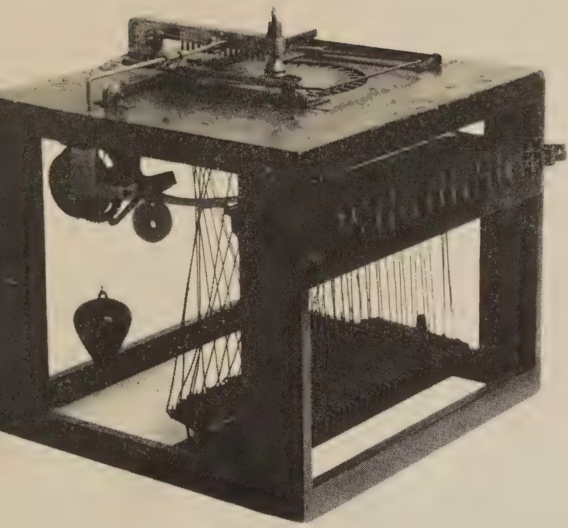
The National Gallery has entered upon a comprehensive educational program in order to make its collections of greatest value to the public. Gallery tours for visitors are conducted twice daily, auditorium lectures and gallery talks are given periodically throughout the year, and a 15-minute talk on the "Picture of the Week" is given every day. Available at the Gallery are general information booklets, catalogs of paint-

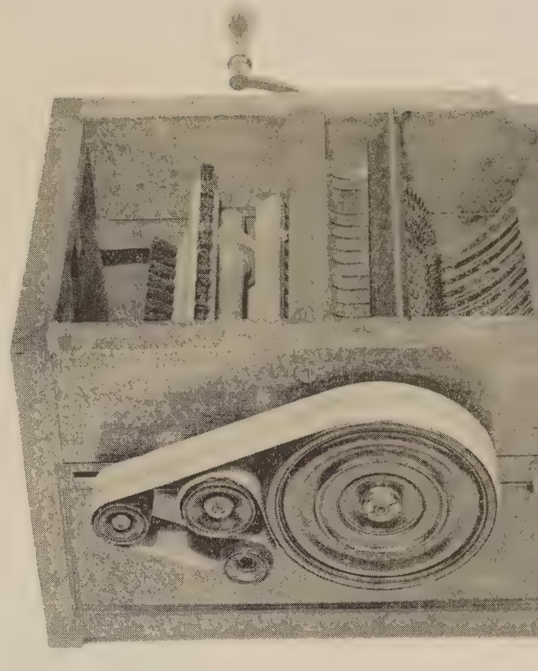
National Gallery of Art, Washington, D. C.

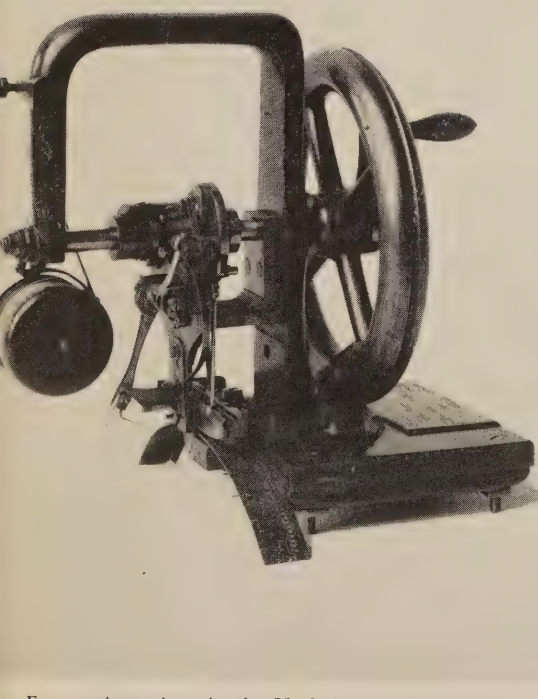
From the collection of dresses of ladies of the White House. *Left*, dress of Harriet Lane Johnston, niece of President Buchanan, 1857-1861; *center*, dress of Mary Harrison McKee, daughter of President Benjamin Harrison, 1892-1893; *right*, dress of Lucretia R. Garfield, wife of President Garfield, 1881.

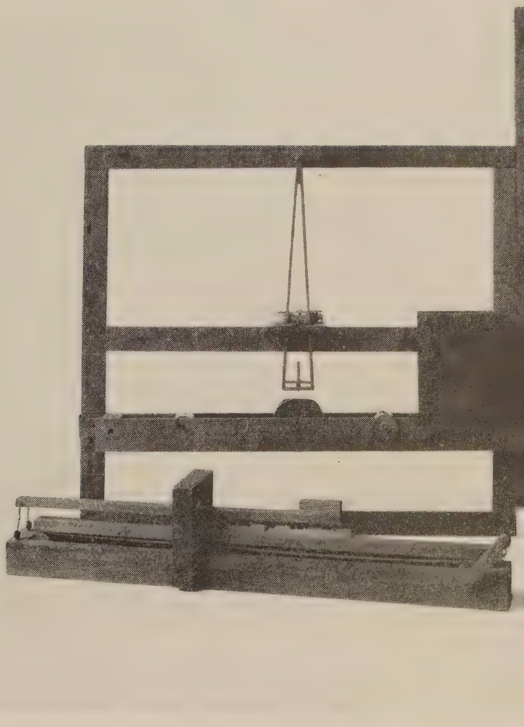
ings and sculpture, complete book of illustrations of all the works of art in the Gallery's collection, color reproductions and postcards.

Thus the art feature of the Smithsonian Institution, which lay practically dormant for the first half of its century of existence, has during the second half grown to such proportions that it comprises today an important part of the Institution. Together, the National Collection of Fine Arts, the Freer Gallery of Art, and the National Gallery of Art constitute a great art center that promises one day to make Washington the art capital of the world. At the Smithsonian, art and science join hands to aid mankind in the achievement of his higher aspirations.









Famous inventions in the U. S. National Museum. *Upper left,* typewriter patented by Sholes, Glidden, and Soule, 1868; *right,* model of the Whitney cotton gin presented to the Museum in 1864 by Eli Whitney, Jr. *Lower left,* the first sewing machine completed by Elias Howe, Jr., in 1845; *right,* Morse telegraph instruments, 1837.

Upper, the original Star Spangled Banner as now exhibited in the U. S. National Museum. *Lower,* George Washington's field kit used by him during the Revolutionary War.

IX

THE DIFFUSION OF KNOWLEDGE

FOR sheer brevity and simplicity Smithson's will is probably unique in the annals of great benefactions. He stated that the institution he wished to found should be for the increase and diffusion of knowledge among men, and there he stopped. In interpreting his words, therefore, the only clue to his intention was the pattern of his own life work—scientific investigation and the writing and publishing of the findings. It seems reasonably certain that the wording of his will points to a desire to see similar work carried on after his death, and this is exactly what the Smithsonian Institution has been doing for 100 years.

Smithsonian Publications

The most obvious means of diffusing knowledge is by the printed word, and this is indeed the chief means employed by the Institution, although there are other methods which will be mentioned later. At the time the Institution was founded, the starting of a new series for the publication of the results of research was of greater relative importance than it is today, because publication media were very few and the provision of a new outlet served both to diffuse knowledge and to stimulate men of science to increased endeavor. The first series established by Secretary Joseph Henry was the quarto Smithsonian Contributions to Knowledge, and the first monograph to appear in the series, as stated previously, was Squier and Davis' "Ancient Monuments of the Mississippi Valley," published in 1848. The Contributions continued to appear until 1916, when the additional expense of printing in quarto form necessitated the termination of the series with the thirty-fifth volume.

Valuable papers in practically every branch of science appeared in the Contributions, the only requirement being that each should constitute a positive addition to knowledge, based on original research. Many of the papers formed monographic summaries of the existing knowledge in various fields, and others stand as announcements of important new discoveries.

A few years after the Contributions started there followed the Smithsonian Miscellaneous Collections, an octavo series intended at the time to contain all other material published by the Institution. Later, as the bureaus now under Smithsonian direction grew out of the Institution's expanding activities, other series became necessary for the publication of their specialized investigations but the Miscellaneous Collections still includes most of the scientific publications of the Institution proper. As the name of the series would indicate, papers in nearly every branch of science appear in its volumes, although biology, anthropology, geology, paleontology, and astrophysics have predominated.

The very first paper in the Miscellaneous Collections, Guyot's "A Collection of Meteorological Tables," led later to what may be considered as among the most useful to date of all Smithsonian publications. The first tables themselves found a wide sphere of usefulness, necessitating several revised and enlarged editions, and as the work grew in size it was found necessary to divide it into several volumes, each comprising tables in a distinct field. Thus there appeared "Smithsonian Meteorological Tables," "Smithsonian Physical Tables," and "Smithsonian Geographical Tables," to which were added later "Smithsonian Mathematical Tables—Hyperbolic Functions" and "Smithsonian Mathematical Formulae and Tables of Elliptic Functions." These volumes have proved to fill a valuable place among reference works and are in very wide use in scientific and industrial laboratories, universities, and other research agencies. During World War II, because of the great expansion of aviation, the Meteorological Tables were in particularly heavy demand, nearly 5,000 copies having been specially printed for the use of the Army and Navy.

Another series of volumes in the Miscellaneous Collections that have proved to be of great value to research workers, especially in the field of meteorology, appeared under the title "Smithsonian World Weather Records," compiled by H. H. Clayton and published through the

assistance of John A. Roebling. The first volume contained official records of pressure, temperature, and precipitation at some 450 stations throughout the world from the date of the earliest observations up to 1920. The second volume covered the decade 1921 to 1930; the third, 1931 to 1940.

Although it is difficult to select titles for special mention from among the more than 2,000 papers in this series, nevertheless a few comparatively recent publications will be listed to show the character and variety of subject matter, as follows: A monograph on "The Skeletal Remains of Early man," by the late Aleš Hrdlička, 1930; a volume of "Essays in Historical Anthropology of North America," by members of the Smithsonian staff, 1940; a long series of papers on new discoveries in Cambrian and pre-Cambrian geology and paleontology by the late Charles D. Walcott, fourth Secretary of the Institution; "A History of Applied Entomology," by L. O. Howard, 1930; two basic papers by the present Secretary, Alexander Wetmore, "A Systematic Classification for the Birds of the World" and "A Check-list of the Fossil Birds of North America"; a series of contributions on the anatomy of insects by R. E. Snodgrass; many papers on various phases of the study of solar radiation and its relation to terrestrial weather by C. G. Abbot, fifth Secretary of the Institution; and two papers by the late R. H. Goddard describing his pioneering work on liquid-propellant rockets, which was supported by the Smithsonian. The Miscellaneous Collections series is now in its one hundred and sixth volume, each volume containing on the average about 20 separate papers.

The Annual Report of the Institution was for the first few years restricted to an administrative account of its activities, but Secretary Henry soon realized that this annual volume presented an excellent medium for reporting on the progress achieved in the various fields of scientific investigation. He therefore added to each Report a General Appendix containing selected articles and reports on advances in the natural and physical sciences, and this practice has been continued down to the present time. The Appendix articles are by competent authorities in their respective fields and are written in nontechnical language for the benefit of the general reader interested in keeping abreast of science progress. The Reports are distributed widely to libra-

ries and educational institutions, where they constitute valuable source material for teachers, students, and the public generally.

The owner of a complete set of the Smithsonian Reports from 1846 to 1946 has in effect a history of 100 years of progress in science, for in the selection of each year's Appendix articles a very large number of scientific journals are screened for suitable accounts of major discoveries. In the pages of the Reports will be found contemporary accounts of the discovery of X-rays, radioactivity, transmutation of elements, and nuclear fission; the beginnings of aeronautics, and steps in the advance of engineering; discoveries in heredity, the spectacular advances in medical knowledge and treatment of disease; progress in methods of locating oil and other minerals; archeological discoveries in all parts of the world that have pushed far back in time the borderline between history and prehistory; and countless other records of the gradual steps taken by the men of science in probing the secrets of nature.

The next four series to be established were the Bulletins and Proceedings of the U. S. National Museum and the Annual Reports and Bulletins of the Bureau of American Ethnology. As these are described in the chapters devoted to those bureaus of the Institution they will be touched on only briefly here.

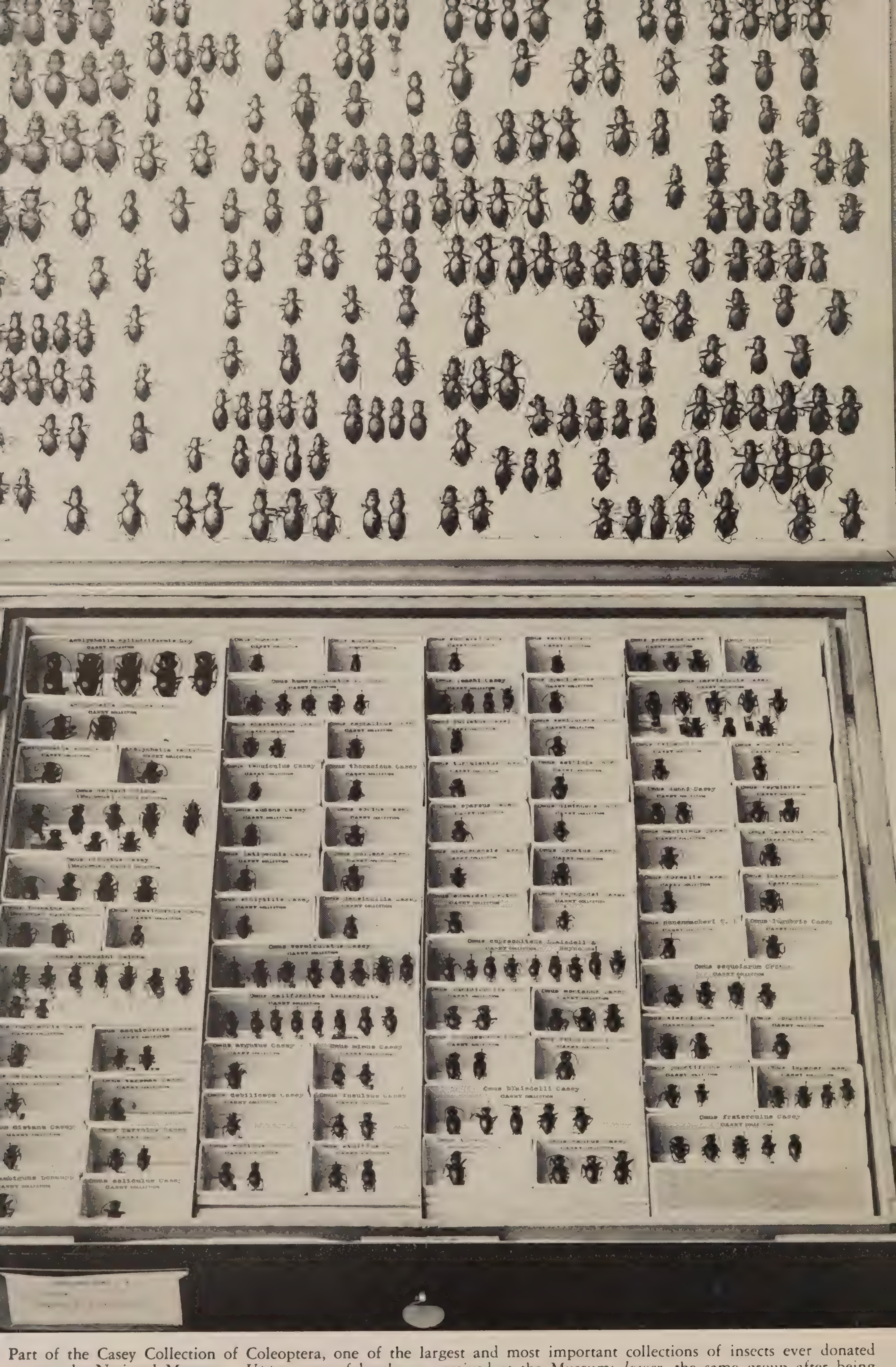
The Bulletins of the Museum are intended to contain the larger monographic studies by members of the staff, and by occasional outside scientists, based largely on the national collections in biology, geology, anthropology, engineering and industries, and American history. The Bulletin series includes many classic volumes, particularly in the various branches of biology, which will stand for a long time as standard reference works. Up to 1946 there have been 192 Bulletins, many of these comprising several volumes.

The Museum Proceedings contain the shorter papers resulting from the researches of the staff and others on the Museum collections, notably the descriptions of thousands of new species discovered in the course of these investigations. Important also are the systematic revisions in the classification and nomenclature of various groups of animals, necessitated by intensive study of large collections. The Proceedings series is now in its ninety-sixth volume, a single volume containing as many as 40 individual papers. Another Museum series, the

Upper, birds of the Antarctic as exhibited in the U. S. National Museum. *Lower*, a part of the study collection in the Division of Mammals, U. S. National Museum.


Habitat groups in the U. S. National Museum. *Upper,* Rocky Mountain sheep. *Lower,* Rocky Mountain goats.

Habitat groups in the U. S. National Museum. *Upper,* Stone's caribou. *Lower,* Alaskan moose.



Part of the Casey Collection of Coleoptera, one of the largest and most important collections of insects ever donated to the National Museum. *Upper*, case of beetles as received at the Museum; *lower*, the same group after being classified and labeled, making them available for later identification work.

Contributions from the U. S. National Herbarium, contains botanical papers by members of the staff of the Division of Plants or by others working on the Museum's great plant collections.

The first publications to be issued by the Bureau of American Ethnology were its quarto Annual Reports, which contained, in addition to the administrative report of the Director, papers by staff members on various phases of American Indian life. After a few years this series was augmented by another—the Bulletins of the Bureau, which contained similar ethnological and archeological studies but in octavo form. These two series continued concurrently until 1930, when the quarto Reports were discontinued in the interests of printing economy, and thereafter all the scientific contributions appeared in the Bulletin series. The 48 Bureau Reports and 143 Bulletins thus far issued constitute a very substantial body of information on the anthropology of the Indians, and many of them, although published many years ago, remain the classic sources in the fields they cover.

Other series issued less frequently, the titles of which are self-explanatory, are the Annals of the Astrophysical Observatory, the Oriental Studies and the Occasional Papers of the Freer Gallery of Art, and the Catalogs of the National Collection of Fine Arts.

All publications of the Institution are distributed free to some 1,500 libraries and scientific and educational institutions, insuring their availability to all who need them. In all the several series, more than 7,500 individual titles have appeared under the Smithsonian imprint, representing a total of some 12,000,000 copies of Smithsonian publications.

International Exchange Service

Another outstanding Smithsonian means of diffusing knowledge has been the International Exchange Service, a bureau of the Institution that grew out of Professor Henry's plan to exchange Smithsonian publications for those of learned institutions abroad. Agents were appointed in a number of foreign countries to carry on this exchange, and as soon as the system became established Professor Henry permitted other organizations and individuals to use the service. This method of international exchange of scientific literature proved to fill an urgent need, and the service grew rapidly with ever-increasing scope. For the

first 30 years the Smithsonian bore the entire cost, but in 1881 Congress began to appropriate annually for its support and has continued to do so to the present time.

By the Brussels Convention of 1886 a number of nations agreed to set up official government agencies to handle the exchange of governmental, scientific, and literary publications, and the Smithsonian service was established as the official United States agency under the name of the International Exchange Service. In 1939, the last normal year before World War II, the Service handled 714,877 packages of such material, weighing a total of 719,694 pounds. This world-wide exchange of literature, initiated by the Smithsonian Institution, has been a potent factor in the rapid growth of science through facilitating the international exchange of ideas. It constitutes, in the best sense, an agency for the diffusion of knowledge.

Other Methods

Other methods employed by the Institution for diffusing knowledge include a large library, museum and art gallery exhibits, a very extensive correspondence, radio programs, and popular science news releases. The Smithsonian library, which has grown largely through exchange and gifts, now numbers close to a million volumes and is one of the largest collections in existence of the proceedings and transactions of learned institutions and societies of the whole world. It forms an invaluable working collection for the use of members of the Institution's staff in connection with their scientific investigations, as well as of outside scientists and students. The museum and art gallery exhibits, which are described in other chapters, are means by which millions of visitors have enriched their store of knowledge. Through its worldwide correspondence, the Institution disseminates knowledge by answering thousands of requests for information in the various branches of science.

As far back as 1923 the Institution sponsored a series of weekly science talks over a local Washington radio station, which succeeded so well that they were continued for more than 4 years. This was among the very first series of scientific talks to be given over the radio. In 1937, in cooperation with the United States Office of Education and

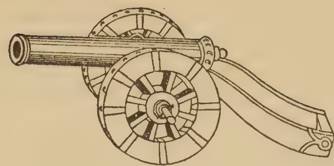
the National Broadcasting Company, there began the Smithsonian nation-wide radio program known as "The World is Yours," which went out over an average of some 85 stations every week for 6 years, and then was terminated only because of the great demand for air time during World War II by Army and Navy organizations. This very popular program was supplemented by printed articles on the broadcast subjects, available to listeners at cost.

For many years the Institution has widened its audience by supplementing the publication program with news releases based on its researches, explorations, and publications. These are sent regularly to a large list of newspapers, press services, and special writers throughout the country.

So for the past 100 years the Smithsonian Institution has utilized every available means for the diffusion of knowledge. Who can estimate the influence of such a program on the acceleration of science progress in America—indeed in the whole world? Only 6 years after the founding of the Institution, Secretary Joseph Henry wrote: "The worth and importance of the Institution is not to be estimated by what it accumulates within the walls of its building, but by what it sends forth to the world. Its great mission is to facilitate the use of implements of research, and to diffuse the knowledge which this use may develop." After the passage of 100 years this statement still expresses the Smithsonian ideal, and it will undoubtedly continue to do so in future years.

Upper, view in the hall of invertebrate paleontology showing fossil sea beach in the foreground, and transcontinental geologic sections with characteristic rocks and fossils along the wall. *Lower*, view in the mineral hall. In the foreground the 12⅞-inch perfect crystal ball. Other cases contain minerals and gems.

Two historic planes as they appear in the U. S. National Museum. *Upper*, Charles A. Lindbergh's *Spirit of St. Louis*. *Lower*, Wiley Post's *Winnie Mae*.



X

THE SMITHSONIAN IN WARTIME

IN time of war, scientific organizations are among the first to be called into the service of their country, as has recently been so strikingly demonstrated in World War II. The wartime service of the Smithsonian Institution, however, goes back much farther than that, for even during the Civil War of 1861-1865, it was called upon to aid the Government. The first Secretary of the Institution, Joseph Henry, was one of three members of a commission of scientists appointed "to examine and report upon various investigations and experiments intended to facilitate the operations of war and to improve the art of navigation." Much of the work was done at the Institution, particularly that in connection with the use of lights for signaling, the top of the Smithsonian's 140-foot tower providing an excellent location for testing methods of using them. Professor Henry was also called upon by the War Department to test the practicability of Lowe's plan for using balloons for military purposes, and experiments in this field were made on the Smithsonian grounds.

During World War I the Secretary of the Institution was Dr. Charles D. Walcott. He served as chairman of the executive committee of the very important National Advisory Committee for Aeronautics, which took such a leading part in the development of aviation in this country. He was also a member of the National Research Council and of several wartime boards and commissions which did much to put science at the service of the Government. The Smithsonian Astrophysical Observatory utilized its personnel and laboratories for original researches in connection with the conduct of the war. Some of the problems investigated were the pressure of wind on projec-

tiles, the designing of a recoilless gun, and the study of suitable searchlights for Army use. Dr. Abbot's success in improving the design of Army searchlights received high commendation from the War Department.

World War II was literally a war of science, and during that titanic struggle the services of the Smithsonian were utilized to an unprecedented extent. Shortly after Pearl Harbor, the Secretary of the Institution, Dr. Charles G. Abbot, appointed a War Committee to canvass the Institution's possibilities and to recommend specific lines of action. As a result a large part of the effort of the staff was devoted to war work, and the Smithsonian became an essential cog in the great war machine in Washington. Many of the services it offered were not readily available elsewhere—services whose lack might well have led to costly mistakes or delays.

Probably the Smithsonian's most effective contribution to the war was its ability to answer without delay urgent calls from the Army and Navy for information in a variety of fields—mainly anthropology, biology, geology, geography, physics and astrophysics, engineering, textiles and fibers, and woods. Many of the requests were for information that had only an indirect war connection, but others led straight to the fighting fronts and had a direct bearing on the progress of the war. Among these latter requests were calls for means of identification of various kinds of disease-bearers such as mosquitoes, rats, and mollusks; for reports on geography, peoples, and other features of areas ahead of the actual fighting; for transliteration of Chinese and Japanese names on maps of war areas; for preparation of a survival manual for aviators and other personnel stranded in unfamiliar areas; and for many other items of equal importance.

The number of recorded requests for technical information from Army, Navy, and war agencies for the war years was 2,695, and it is known that many more for various reasons were not recorded. Some calls for "spot" information could be answered immediately, but many required research to a varied degree and some led to extended written reports with illustrations.

As a means of bringing together in one place all the known resources of specialized and regional knowledge so urgently needed by the Army and Navy, particularly in the early days of the war, the Institution

joined with the National Research Council, the American Council of Learned Societies, and the Social Science Research Council in setting up the Ethnogeographic Board with offices in the Smithsonian Building. The Board proved almost immediately to fill a vital place among the Washington war agencies. Besides making available to the Army and Navy a great regional file of specialists able to assist in the solution of problems relating to all parts of the world, the Board produced on request numerous special reports on particular regions for use in planning military operations, and served as a real clearinghouse for spot information in many different fields.

Although the Institution has no large laboratories that could be used for extensive war investigations, nevertheless its smaller laboratories and shops and the specialized knowledge of its personnel were made available for whatever researches were requested by Army and Navy officials. The facilities and staff of the Astrophysical Observatory, including the Division of Radiation and Organisms, were occupied for a considerable time with research on the heat-radiation properties of various textiles, pigments, and other materials used for war purposes, and on the deterioration of impregnated cloth, cardboard, and other materials used by the Navy. A number of special instruments were developed and constructed for the Navy. At the request of the Office of Scientific Research and Development, an extended study was made to find a filter which would exclude undesired types of radiation and transmit certain desired wave lengths. The Astrophysical Observatory has currently in progress a series of measurements of sun and sky radiation which are a part of extensive tests conducted by the Office of the Quartermaster General to determine causes for the deterioration of tents and tent materials. The results of these tests will doubtless be applicable to a wide range of fabrics.

In geology, one Museum staff member was in the field continuously throughout the war directing an investigation for the United States Geological Survey of Mexico's resources of strategic minerals. Another member took part in a study of geological strata in an economic survey of the ore and mineral deposits of northern Mexico, and later investigated Devonian stratigraphy in Illinois in connection with oil resource studies.

Much of the work in the field of biology was in the nature of continuous assistance to war-agency personnel through identification of specimens, instruction in various fields of medical biology, training of military personnel in identification work, conferences on recognition and control of harmful organisms, reports on the occurrence and identification of strategic plant material, and other similar activities.

In anthropology, staff members prepared a number of reports and articles involving research on the native peoples of various war areas at the request of Army and Navy intelligence officers. Studies of Arctic clothing were made for the Army Quartermaster Corps, based on the extensive collections of Eskimo garments in the National Museum. For use in the design of oxygen and gas masks, data were worked out and supplied to the Army on the variations in size and form of the human head and features.

These are but a few of the war research problems investigated by the Smithsonian, but they will serve to show the type of work the Institution was qualified to do.

With the outbreak of war came the realization that Western Hemisphere solidarity was not only desirable but essential to the safety of the countries of both continents. It became an urgent duty of the United States Government to take the lead in promoting good-will, cooperation, and a feeling of unity among all the American republics. The Smithsonian Institution was qualified to take part in such a program through its long years of friendly contact with scientists and scientific institutions in South and Central America, Mexico, and the West Indies, and its continuous program of field explorations in those regions. The units of the Institution most concerned with inter-American cooperative work have been the National Museum and the Bureau of American Ethnology.

Examples of this work were numerous biological expeditions to South and Central American countries which worked in cooperation with the scientists of those countries; in cooperation with the Department of State, the preparation of a five-volume Handbook of South American Indians, of which 50 percent of the authors were anthropologists of the other American republics, and the creation of the Institute of Social Anthropology to cooperate with institutions of other American countries in training personnel to carry out anthropological

research; publication of a check-list of the Coleoptera of Latin America; and cooperative geological investigations in Mexico.

One of the War Committee's first recommendations was the publication of a series of authentic papers on the peoples, history, geography, and other features of war areas, particularly in the Pacific theater of operations, which were largely unfamiliar to most Americans. Under the title Smithsonian War Background Studies, 21 papers were issued, which covered practically every country and island group involved in the war in the Pacific, in addition to several on other war areas of special interest and on general war background topics. The series became popular at once, and when it came to the attention of the Army and Navy large numbers of copies were ordered for orientation use in the armed services. In all, more than 600,000 copies were printed.

IN assessing the worth of the Smithsonian Institution's first one hundred years of operation, two principal questions arise: Have James Smithson's express wishes been faithfully carried out?—and, to what extent has the Institution's work benefited the people of America and of the whole world?

To answer the first of these questions, we have reviewed very briefly in this historical sketch Smithsonian activities in the increase and diffusion of knowledge. We have seen that the Institution has conducted and supported original scientific investigations in many fields that have added a very large amount of new knowledge to the previously existing stock; it has explored the whole earth in the interests of a fuller knowledge of our planet and of its inhabitants, human and animal; it has greatly expanded man's understanding of the sun, that star on which all life on earth depends; it has produced a whole body of new knowledge concerning the American Indians and other aboriginal peoples; and it has made all this new knowledge freely available to all mankind through its publications, through its International Exchange Service, through its million-volume library, through museum and art gallery exhibits, through a world-wide correspondence, and through nation-wide radio programs and popular-science news releases.

The second question, concerning the value to mankind of Smithsonian work, is not so easily answered. Such values are not readily assessable, for cultural benefits are largely intangible. Yet the benefits are just as real as more material advantages—in fact, are of far greater importance with relation to the mental and spiritual aspects of man's development, through which alone he can hope to achieve his higher destiny. Without the great advances in knowledge brought about in recent centuries through the agency of such organizations as the Smithsonian Institution, civilized mankind would still live in superstitious fear of nature and his advancement would still be blocked by blind ignorance and dogma. On the other side of the picture, the Smithsonian has had a very real part in the great upsurge of scientific progress of the last century which has resulted in so many economic applications for the direct benefit of mankind. So on both the cultural and material levels, the Institution has measurably served the human race.

On the Smithsonian's recent radio series, "The World Is Yours," each program opened against a background of theme music with the words: "Men have searched the earth, the air, even the sun and stars, in their never-ending quest for knowledge." As the Institution pauses on crossing its first hundred-year mark to survey its past achievements, its officers and staff dedicate themselves to increased effort in the quest for knowledge and in the projection into the future of James Smithson's noble benefaction.